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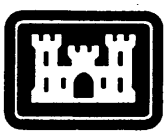

US Army Corps of Engineers
Waterways Experiment Station

Installation Restoration Research Program

Environmental Assessment of Selected Cone Penetrometer Grouts and a Tracer

by Thomas D. Wright
Environmental Laboratory

Prepared for Headquarters, U.S. Army Corps of Engineers

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U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Final report

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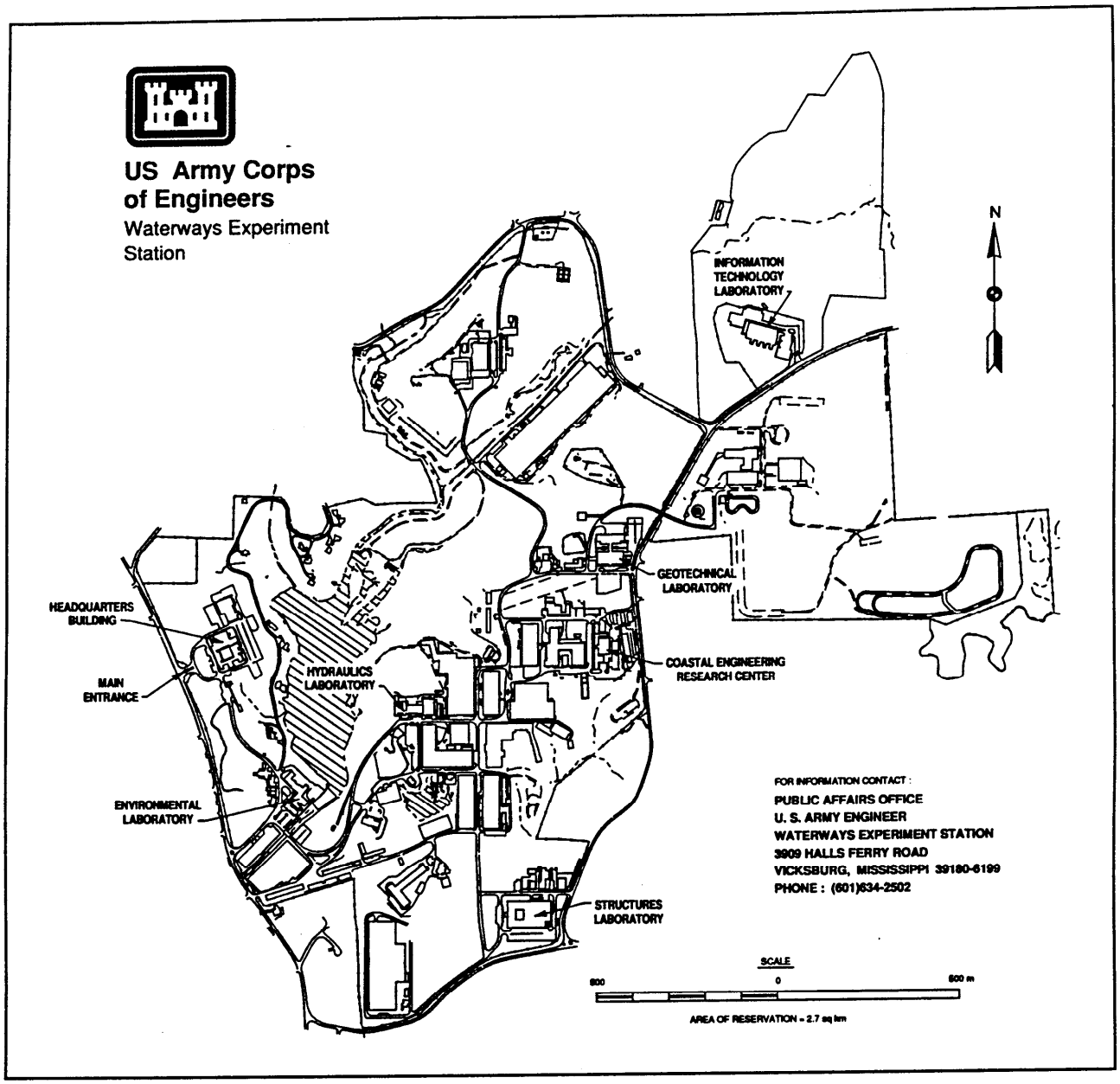
Prepared for U.S. Army Corps of Engineers
Washington, DC 20314-1000



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Contents

Preface

The study reported herein was conducted by the Environmental Laboratory (EL) of the U.S. Army Engineer Waterways Experiment Station (WES). The research was sponsored by the Department of the Army Installation Restoration Research Program (IRRP). Dr. Clem Meyer was the IRRP Coordinator at the Directorate of Research and Development, Headquarters, U.S. Army Corps of Engineers (HQUSACE). Dr. Bob York of the U.S. Army Environmental Center (USAEC) and Mr. Jim Baliff of the Environmental Restoration Division, Directorate of Military Programs, HQUSACE, served as the IRRP Overview Committee. Technical Monitors were Ms. Sandra Cotter of the U.S. Army Engineer Division, Missouri River, and Mr. Wayne Sisk of USAEC. The WES Program Manager was Dr. John Cullinane.

This report was prepared by Dr. Thomas D. Wright of the Fate and Effects Branch (FEB), EL. The work was conducted under the direct supervision of Dr. Bobby L. Folsom, Jr., Chief, FEB, and under the general supervision of Mr. Donald L. Robey, Chief, Environmental Processes and Effects Division, and Dr. John Harrison, Director, EL.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Bruce K. Howard, EN.

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Wright, Thomas D. (1993). "Environmental assessment of selected cone penetrometer grouts and a tracer," Miscellaneous Paper IRRP-93-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Summary

Concern has been expressed that grouts used to seal cone penetrometer holes and soluble tracers used in conjunction with penetrometer investigations might introduce contaminants into groundwater and thereby pose a potential environmental hazard. A risk assessment approach was used to evaluate this potential. For the effects phase of the assessment, data were obtained for representative inorganic (clays, cement, and chemical) and organic (urethane) grouts and a fluorescent tracer. Based on information found in material safety data sheets, environmental hazards from the grouts and the tracer were not found to be significant with the possible exception of oral ingestion of undiluted or unreacted components. The exposure phase of the assessment was not conducted because no significant effects were identified. The selected grouts and the tracer are recommended for use with cone penetrometer investigations. Grouts or tracers other than those evaluated will require material-specific evaluation.

1 Introduction

Background

The Site Characterization and Analysis Penetrometer System (SCAPS) was developed by the U.S. Army Engineer Waterways Experiment Station to investigate terrestrial hazardous and toxic waste (HTW) sites. The system is mounted on a truck and is capable of pushing a 3.56-cm rod into the ground to a depth of 45 m.[1] Following penetration, the rod is withdrawn and the hole is grouted to prevent potential horizontal and vertical migration of HTW contaminants. On occasion, a tracer may be introduced into the penetrometer hole to monitor groundwater movement.

Although one of the purposes of the grout is to prevent potential migration of contaminants resulting from the penetrometer hole, concerns have been raised that the grout itself or the tracer might potentially constitute a source of contamination. This could occur if the penetrometer entered groundwater, and contaminants present in the grout or tracer could be directly introduced into the groundwater. Leaching and subsequent contamination is also possible. An environmental hazard through oral ingestion of the contaminants in groundwater might result. Of course, failure of the grout could result in a direct contamination of the groundwater by HTW contaminants at the site, but that is outside the scope of this report. This report will address only the potential direct effects of oral ingestion of contaminants which might be released into groundwater by selected grouts used to plug and/or seal cone penetrometer holes or by the introduction of a selected tracer. Work Unit AF25-CT-002, Biological Evaluation of Materials Used in Cone Penetrometer Grouting and Tracer, was developed to address this potential source of contamination.

SCAPS development was initiated in 1986. Because of equipment limitations, it was originally believed that multicomponent organic grouts would be required for successful grouting through the 3.56-cm penetrometer rod. The organic chemicals used in these grouts can have potentially adverse health and

[1] U.S. Army Corps of Engineers. (1991). "Innovative technology site characterization and analysis penetrometer system (SCAPS); A rapid, inexpensive means to study physical and chemical characteristics of soils at hazardous waste sites," Washington, DC.

environmental impacts, and the products of incomplete polymeric reactions may complicate site characterization. Anticipated resistance to the use of synthetic grouts by Federal and state regulatory agencies necessitated planning for the environmental effects assessment of the grouts proposed for use with the SCAPS. As discussed below, field experience during the past 2 years has demonstrated that the environmental effects issue has been largely overcome by events.

First, cement and bentonite grouts are commonly specified *a priori* by Federal and state regulatory agencies as the most appropriate grouts for use on uncontrolled hazardous waste sites.[1] These grouts are commonly used during installation of conventional site characterization monitoring wells, and the regulators have significant experience in their use. Further, since these grouts are composed of commonly used construction materials, their environmental effects are considered to be relatively benign.

Second, field trials have proven the technical feasibility of using the more conventional cement- and bentonite-based grouts with the SCAPS. In addition, private sector vendors have successfully used cement- and bentonite-based grouts with cone penetrometer systems.[2]

Third, there are no documented cases in which environmental effects associated with grouts have resulted in delay or cancellation of a SCAPS project. Grout environmental effects issues have been successfully resolved through discussions with appropriate regulating agencies.[2]

Finally, experience with Federal and state regulators has not led to the development and execution of a universally acceptable environmental effects evaluation protocol for the synthetic-based grouts. Site-specific conditions and regulatory preferences appear to necessitate the use of site-specific protocols, e.g., some regulators have suggested the necessity for using site groundwater to conduct any leaching/toxicology tests.[2] Carried to its extreme, this philosophy would require separate site-specific environmental effects studies for each site on which the SCAPS is used.

The developments described above have, to a large extent, obviated the need for conducting environmental assessments on a large number of grouts or developing grouts specifically for the SCAPS. It is prudent to conduct an environmental effects review of the grouts and tracers that are currently anticipated to be used with the SCAPS to assist in obtaining regulatory approval for its use.

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[1] Personal Communication, 1992, Philip Malone, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

[2] Personal Communication, 1992, Stafford Cooper, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Objective

The objective of this report is to assess the potential of selected grouts and a tracer used in conjunction with the SCAPS for contaminating groundwater. Because a variety of grouts and tracers were originally proposed, a generic list considering operational considerations and planned use was developed by the SCAPS team. Grouts and tracers not included in this generic list will require material-specific consideration. The generic grouts and the tracer are

a. Bentonite clay.

b. Attapulgite clay.

c. Microfine portland cement.

d. Joosten grout (calcium silicate grout).

e. Urethane grout.

f. Fluorescent tracer.

Approach

The approach chosen to evaluate the potential problem is a risk assessment. The risk assessment has two components--effects assessment and exposure assessment. The effects assessment will address potential health effects such as chronic and acute toxicity, carcinogenicity, mutagenicity, and teratogenicity. The primary sources of this information are the material safety data sheets (MSDS) required by the Occupational Safety and Health Administration (OSHA) as per 29 CFR 1910.1200. These data sheets are provided by the manufacturer or supplier. If the effects assessment warrants, an exposure assessment should be performed.

The primary items of interest in the MSDS are Sections 2 (Hazardous Ingredients) and 5 (Health Information). In some instances the information provided is not pertinent to this report as, for example, inhalation or dermal contact with unreacted components. Where a potential health hazard is indicated, it is necessary to determine the route of exposure. Further, the manufacturer/supplier is not required to provide information where a particular route of exposure is unlikely, such as the oral ingestion of concrete. As noted above, only oral ingestion through groundwater is considered in this report. In Chapter 2, the grouts and the tracer used in conjunction with the SCAPS are assessed with regard to their potential for groundwater contamination. Each MSDS is reproduced in Appendix A.

2 Results

Each MSDS was assessed regarding the potential of the material to contaminate groundwater. Results of this analysis are summarized below.

- **Bentonite clay.** Information was obtained from Baroid Drilling Fluids, Inc., on three bentonitic clay products (trade names: Benseal, Aquagel, and Aquagel Gold Seal). In addition, information was obtained on a catalyst, Aqua-Grout Catalyst.

- **Attapulgite clay.** Information was obtained from Baroid Drilling Fluids, Inc., on an attapulgite clay product (trade name: Zeogel).

- **Microfine portland cement.** Information was obtained for two microfine portland cements. Lehigh Geocem is manufactured by Lehigh Portland Cement Company, and Micro Matrix Cement is sold by Halliburton Services, Inc.

- **Joosten grout.** Joosten grout consists of calcium silicate. It is formed by the reaction of sodium silicate and calcium chloride to form calcium silicate and sodium chloride. Information on all these compounds was obtained from Sax[1] as well as the material safety data sheets. No MSDS on sodium chloride exists, as it is not regulated by OSHA.

- **Urethane grout.** Information was obtained for three urethane grouts and their catalysts. Mountain Grout and its catalyst, Pure Catalyst, is marketed by Green Mountain, Inc. TACSS 020 NF/TACSS 025 NF and its catalyst, TACSS Accelerator C-852/C-855, is manufactured by De Neef America, Inc. Scotch-Seal 5600 is manufactured by Minnesota Mining and Manufacturing (3M).

- **Fluorescent tracer.** Information was obtained on one fluorescent tracer. Fluoretract II is manufactured by Formulabs, Inc.

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[1] N. Irving Sax. (1968). *Dangerous properties of industrial materials.* Reinhold, New York, 522, 527, 1114.

3 Discussion and Conclusions

Grouts, as classically employed, are used to fill holes, cracks, and voids in structures or as sealants. These include concrete structures such as water supply reservoirs and distribution systems. Grouts for such purposes should not be a source of contaminants. Further, by definition, grouts should have little solubility in water, and any trace contaminants present should be sequestered in the cured grout matrix. During the curing process grouts may produce or release substances that may be deleterious, but this should be minimal. After curing, a very small amount of surface leaching from the grout may occur. Grouts are very commonly used to plug or seal abandoned oil, gas, and water wells and borings for geological, mineral, foundation, and other exploratory purposes. The grout prevents the horizontal and vertical movement of water and other fluids or gases. As noted in Appendix B, many States provide guidance on particular grouts for specific purposes. These consist primarily of bentonite clays, cement, or combinations of the two.

Tracers are used to determine the movement of fluids. Tracers may be introduced into reservoirs, groundwater, rivers, or water distribution systems. When properly used, they are not considered to be contaminants. A very common application is their introduction into drain fields to determine the movement of effluents.

Bentonite Clay

This inorganic material is also known as Wyoming bentonite or sodium montmorillonite and is a sodium aluminum silicate. The only hazardous ingredient listed on the MSDS for the three formulations and the catalyst is silica. There is no indication of adverse effects from oral ingestion. One formulation, Benseal, is specifically recommended for sanitary sealing during water well construction, and all metals are within drinking water standards as determined by the U.S. Environmental Protection Agency's Toxicity Characteristics Leaching Procedure.

Attapulgite Clay

This inorganic material is a magnesium aluminum silicate. The only hazardous ingredient listed on the MSDS is silica. There is no indication of adverse effects from oral ingestion.

Microfine Portland Cement

This inorganic material consists of various calcium silicates, aluminates, and similar calcium salts that are not readily separable into individual components. Because it is manufactured from raw materials mined from the earth, trace (but detectable) amounts of many naturally occurring elements and compounds may be found by chemical analysis. The only hazardous ingredient listed on the MSDS is silica, and there is no indication of adverse effects from oral ingestion.

Joosten Grout

This inorganic grout is produced by the reaction of sodium silicate and calcium chloride to form calcium silicate and sodium chloride. The usual procedure in using this grout is for the operator to obtain the reaction products in bulk and inject them into the cavity. The reaction is very rapid, and injection consists of both liquids being simultaneously inserted while the injection tubes are withdrawn. Calcium chloride and calcium silicate are food additives. Calcium chloride and sodium silicate also migrate into food from packaging materials. Sodium chloride is commonly known as table salt. The toxic hazard rating code for all of these compounds for oral ingestion is 1 (slight: causes readily reversible changes that disappear after end of exposure).[1] As with all salts of this nature, oral ingestion of extremely large quantities (thousands of milligrams per kilogram) can be lethal.

Urethane Grout

These organic grouts are urethane polymers (polyurethanes). Hazardous ingredients listed on the MSDS for these polymers and their catalysts include aliphatic amines, methylene diphenyl isocyanate, toluene diisocyanate, free isocyanate, acetone, and polyether prepolymer. Unreacted toluene diisocyanate is a potential carcinogen. However, after the curing process is complete, all three proprietary products are approved for potable water contact. The

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[1] N. Irving Sax. (1968). *Dangerous properties of industrial materials.* Reinhold, New York, 522, 527, 1114.

MSDS recommends that a physician be called in the event of oral ingestion of unreacted components. This would not apply to the cured grout itself.

All of the selected grouts have potential adverse effects from inhalation and/or dermal exposure. These are limited to the exposure to components, rather than to the final grout mixture. For example, cement can cause severe chemical burns as it is a highly caustic compound. However, the end product, concrete, is essentially inert. Likewise, the silica in cement dust is a possible carcinogen and is known to cause lung inflammation and silicosis. Adequate ventilation and other protective measures are necessary during the use of the selected grouts to prevent or minimize exposure to particulates, fumes, or vapors through inhalation.

Fluorescent Tracer

The MSDS for this organic tracer indicates that no hazardous ingredients are present. Oral ingestion of the concentrate may cause nausea or result in yellow-green urine until the tracer has been flushed from the system. No adverse effects are expected from either acute or chronic exposure. This organic tracer is not carcinogenic, teratogenic, or mutagenic.

Conclusion

Effects assessment of several representative grouts and a tracer proposed for use with the SCAPS showed that environmental hazards from grout or tracer-associated contaminants are of little significance. This being the case, exposure assessment is not necessary. The selected grouts, and especially those required by the States (Appendix B), are recommended for sealing SCAPS borings.

Appendix A
Material Safety Data Sheets

IV. FIRE AND EXPLOSION DATA

WILL NOT SUPPORT COMBUSTION.
NO FIRE OR EXPLOSION HAZARD.
EXTINGUISHING MEDIA: WATER, FOAM, CARBON DIOXIDE.

V. HEALTH HAZARD INFORMATION

CARCINOGENICITY - SEE ROUTES OF EXPOSURE AND EFFECTS

ACUTE ORAL LD50	ACUTE DERMAL LD50	AQUATIC TOXICITY LC50
ND	ND	10,000 mgl

ROUTES OF EXPOSURE AND EFFECTS

THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBITED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. NUISANCE DUST TLV = 10 mg/m3. OSHA PEL: CLASSIFIED AS A NUISANCE DUST WHEN LESS THAN 1% CRYSTALLINE SILICA IS PRESENT. IF GREATER THAN 1% CRYSTALLINE SILICA, THEN EXPOSURES SHALL NOT EXCEED AN 8-HOUR TIME-WEIGHTED AVERAGE LIMIT AS STATED IN 29 CFR 1910.1000 TABLE Z-1-A FOR AIR CONTAMINANTS, SPECIFICALLY; SILICA; CRYSTALLINE QUARTZ (RESPIRABLE) 0.1 mg/m3.
IRRITANT TO EYES, NOSE AND LUNGS; PROLONGED INHALATION OF DUST MAY RESULT IN SILICOSIS, A NONCANCEROUS LUNG DISEASE.

EMERGENCY AND FIRST AID PROCEDURES

NO PROCEDURES REQUIRED BEYOND NORMAL PERSONAL HYGIENE - WASH ALL CONTACTED AREAS WITH SOAP AND WATER.

VI. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
STABLE

INCOMPATIBILITY
NONE

HAZARDOUS DECOMPOSITION PRODUCTS
NONE

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
WILL NOT OCCUR

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
NORMAL HOUSEKEEPING, CAUSES SLIPPERY SURFACES WHEN WET.

NEUTRALIZING CHEMICALS
NA

WASTE DISPOSAL METHOD
DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS
MECHANICAL, GENERAL ROOM VENTILATION.
USE LOCAL VENTILATION TO MAINTAIN TLV (SEE SECTION V).

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY
IF DUST CONCENTRATIONS EXCEED TLV USE A NIOSH APPROVED DUST RESPIRATOR

EYE
GOGGLES

GLOVES
WORK GLOVES

OTHER CLOTHING AND EQUIPMENT
APRON, EYEWASH STATION

IX. SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

AVOID PROLONGED INHALATION.
RECOMMENDED LABELING:
FRONT PANEL: CAUTION
SEE BACK PANEL FOR CAUTION BEFORE USE.
BACK PANEL: CAUTION
THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBITED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. PROLONGED INHALATION OF THE POWDER MAY RESULT IN SILICOSIS, A NONCANCEROUS LUNG DISEASE. AVOID CREATING DUSTY CONDITIONS AND USE A NIOSH APPROVED DUST RESPIRATOR.

OTHER HANDLING AND STORAGE REQUIREMENTS

STORE IN A SHELTERED AREA OR COVER FOR MOISTURE PROTECTION.

X. DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME :
NOT REGULATED

PLACARDS :
NONE

HAZARD CLASS :
NOT HAZARDOUS

REPORTABLE QUANTITY :
NONE

HAZARDOUS SUBSTANCE :
NONE

ID NUMBER :
NONE

LABEL :
NONE REQUIRED

Prepared by:
Environmental Services

DATE:
August,1991

XI. REGULATORY INFORMATION

STATUS ON SUBSTANCE LISTS

Comprehensive Environmental Response, Compensation and Liability Act of 1980, (CERCLA) requires notification of the National Response Center of release of quantities of Hazardous Substances equal to or greater than the reportable quantities (RQs) in 40 CFR 302.4.

Components present in this product which may require notification are:

Chemical	CAS Number
NONE	

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on RQs.
Components present in this product at a level which could require reporting under the statute are:

NONE

SARA requires the submission of annual reports of toxic chemicals that appear in 40 CFR 372 (for SARA 313). This information must be included in all MSDS that are copied and distributed for this material.
Components present in this product at a level which could require reporting under the statute are:

NONE

Toxic Substances Control Act (TSCA)
The ingredients of this product are on the TSCA inventory.

XII. STATE RIGHT TO KNOW

NOT ON ANY LISTS.

Prepared by:
Environmental Services

DATE:
August,1991

IV. FIRE AND EXPLOSION DATA

AQUAGEL IS NOT FLAMMABLE AND NOT EXPLOSIVE. DOES NOT SUPPORT COMBUSTION.
EXTINGUISHING MEDIA: WATER

V. HEALTH HAZARD INFORMATION

CARCINOGENICITY - SEE ROUTES OF EXPOSURE AND EFFECTS BELOW

ACUTE ORAL LD50	ACUTE DERMAL LD50	AQUATIC TOXICITY LC50
ND	ND	ND

ROUTES OF EXPOSURE AND EFFECTS

THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBTED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. PROLONGED INHALATION OF THE POWDER MAY RESULT IN SILICOSIS, A NONCANCEORUS LUNG DISEASE.
OSHA FINAL LIMITS TWA = 0.1 mg/m3
EYES: IRRITANT SKIN: POTENTIAL IRRITANT INHALATION: IRRITATION TO LUNGS, NOSE, AND THROAT; PROLONGED INHALATION MAY CAUSE LUNG INJURY OR DISEASE.

EMERGENCY AND FIRST AID PROCEDURES

EYES: FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES.
WASH AREAS OF CONTACT WITH SOAP AND WATER.

VI. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
THIS PRODUCT IS STABLE UNDER NORMAL CONDITIONS

INCOMPATIBILITY
NONE

HAZARDOUS DECOMPOSITION PRODUCTS
NONE

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
NONE

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
NORMAL HOUSEKEEPING, CAUSES SLIPPERY SURFACES WHEN WET.

NEUTRALIZING CHEMICALS
NA

WASTE DISPOSAL METHOD
DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS
MECHANICAL, GENERAL ROOM VENTILATION. USE LOCAL VENTILATION TO MAINTAIN TLV (SEE SECTION V)

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY
USE A NIOSH APPROVED MECHANICAL FILTER RESPIRATOR FOR NONTOXIC DUSTS.

EYE
GOGGLES

GLOVES
WORK GLOVES

OTHER CLOTHING AND EQUIPMENT
APRON, EYEWASH STATION

IX. SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

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GENICITY
IN HUMANS. PROLONGED INHALATION OF THE POWDER MAY RESULT IN
SILICOSIS, A
NONCANCEROUS LUNG DISEASE. AVOID CREATING DUSTY CONDITIONS AND
USE A
NIOSH APPROVED DUST RESPIRATOR.

OTHER HANDLING AND STORAGE REQUIREMENTS

STORE IN SHELTERED AREA OR COVER FOR MOISTURE PROTECTION.

X. DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME :
NOT REGULATED

PLACARDS :
NONE

HAZARD CLASS :
NONE

REPORTABLE QUANTITY :
-

HAZARDOUS SUBSTANCE :
NONE

ID NUMBER :
NONE

LABEL :
NONE REQUIRED

Prepared by:
Environmental Services

DATE:
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Components present in this product which may require notification are:

Chemical	CAS Number
NONE	

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on RQs.
Components present in this product at a level which could require reporting under the statute are:

SARA requires the submission of annual reports of toxic chemicals that appear in 40 CFR 372 (for SARA 313). This information must be included in all MSDS that are copied and distributed for this material.
Components present in this product at a level which could require reporting under the statute are:

Toxic Substances Control Act (TSCA)
The ingredients of this product are on the TSCA inventory.

XII. STATE RIGHT TO KNOW

QUARTZ IS ON CANADIAN WHMIS (WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM) INGREDIENT DISCLOSURE LIST, MASSACHUSETTS SUBSTANCE LIST, NEW JERSEY RIGHT TO KNOW HAZARDOUS SUBSTANCE LIST AND PENNSYLVANIA HAZARDOUS SUBSTANCE LIST.

Prepared by:
Environmental Services

DATE:
August,1991

IV. FIRE AND EXPLOSION DATA

AQUAGEL GOLD SEAL IS NOT FLAMMABLE AND NOT EXPLOSIVE, DOES NOT SUPPORT COMBUSTION.
EXTINGUISHING MEDIA: WATER

V. HEALTH HAZARD INFORMATION

CARCINOGENICITY - SEE ROUTES OF EXPOSURE AND EFFECTS (BELOW)

ACUTE ORAL LD50	ACUTE DERMAL LD50	AQUATIC TOXICITY LC50
ND	ND	ND

ROUTES OF EXPOSURE AND EFFECTS

THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBITED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. PROLONGED INHALATIN OF THE POWDER MAY RESULT IN SILICOSIS, A NONCANCEROUS LUNG DISEASE. OSHA FINAL LIMITS TWA = 01. mg/m3. IF CRISTOBALITE OR TRIDYMITE IS DETECTED, USE ONE HALF THE VALUE CALCULATED FROM FORMULA FOR QUARTZ.
EYES: IRRITANT SKIN: POTENTIAL IRRITANT INHALATION: IRRITATION TO LUNGS, NOSE, AND THROAT; PROLONGED INHALATION MAY CAUSE LUNG INJURY OR DISEASE.

EMERGENCY AND FIRST AID PROCEDURES

WASH AREAS OF CONTACT WITH SOAP AND WATER.
FLUSH EYES WITH LARGE AMOUNT OF WATER FOR AT LEAST 15 MINUTES.

VI. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
THIS PRODUCT IS STABLE UNDER NORMAL DRILLING CONDITIONS.

INCOMPATIBILITY
NONE

HAZARDOUS DECOMPOSITION PRODUCTS
NONE

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
NONE

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
NORMAL HOUSEKEEPING, CAUSES SLIPPERY SURFACES WHEN WET.

NEUTRALIZING CHEMICALS
NA

WASTE DISPOSAL METHOD
DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REGULATIONS

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VENTILATION REQUIREMENTS
MECHANICAL, GENERAL ROOM VENTILATION
USE LOCAL VENTILATION TO MAINTAIN TLV (SEE SECTION V)

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY
USE A NIOSH APPROVED MECHANICAL FILTER RESPIRATOR FOR NON TOXIC DUSTS.

EYE
NONE REQUIRED

GLOVES
NONE REQUIRED

OTHER CLOTHING AND EQUIPMENT
APRON, EYEWASH STATION

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OTHER HANDLING AND STORAGE REQUIREMENTS

STORE IN SHELTERED AREA, OR COVER FOR MOISTURE PROTECTION.

X. DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME :
NOT REGULATED

PLACARDS :
NONE

HAZARD CLASS :
NOT HAZARDOUS

REPORTABLE QUANTITY :
NONE

HAZARDOUS SUBSTANCE :
NONE

ID NUMBER :
NONE

LABEL :
NONE

Prepared by:
Environmental Services

DATE:
August,1991

XI. REGULATORY INFORMATION

STATUS ON SUBSTANCE LISTS

Comprehensive Environmental Response, Compensation and Liability Act of 1980, (CERCLA) requires notification of the National Response Center of release of quantities of Hazardous Substances equal to or greater than the reportable quantities (RQs) in 40 CFR 302.4.

Components present in this product which may require notification are:

Chemical	CAS Number
NONE	

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on RQs.
Components present in this product at a level which could require reporting under the statute are:

NONR

SARA requires the submission of annual reports of toxic chemicals that appear in 40 CFR 372 (for SARA 313). This information must be included in all MSDS that are copied and distributed for this material.
Components present in this product at a level which could require reporting under the statute are:

NONE

Toxic Substances Control Act (TSCA)
The ingredients of this product are on the TSCA inventory.

XII. STATE RIGHT TO KNOW

QUARTZ IS ON CANADIAN WHMIS (WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM) INGREDIENT DISCLOSURE LIST, MASSACHUSETTS SUBSTANCE LIST, NEW JERSEY RIGHT TO KNOW HAZARDOUS SUBSTANCE LIST AND PENNSYLVANIA HAZARDOUS SUBSTANCE LIST.

Prepared by:
Environmental Services

DATE:
August,1991

IV. FIRE AND EXPLOSION DATA

FLASH POINT: NONE
FLAMMABILITY LIMITS: NOT APPLICABLE
FIRE EXTINGUISHING MEDIA: USE MEDIA APPLICABLE TO THE SURROUNDING MATERIAL
SPECIAL FIREFIGHTING PROCEDURES: WEAR FULL PROTECTIVE EQUIPMENT INCLUDING SELF-CONTAINED BREATHING APPARATUS.
UNUSUAL FIRE AND EXPLOSION HAZARD: TOXIC GASES MAY BE RELEASED WHEN BURNED.

V. HEALTH HAZARD INFORMATION

CARCINOGENICITY - SEE ROUTES OF EXPOSURE AND EFFECTS (BELOW)

ACUTE ORAL LD50	ACUTE DERMAL LD50	AQUATIC TOXICITY LC50
ND	ND	ND

ROUTES OF EXPOSURE AND EFFECTS

THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBITED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. NUISNCE DUST TLV - 10 mg/m3 OSHA PEL: CLASSIFIED AS A NUISANCE DUST WHEN LESS THAN 1% CRYSTALLINE SILICA IS PRESENT. IF GRETER THAN 1% CRYSTALLINE SILICA, THEN EXPOSURES SHALL NOT EXCEED AN 8-HOUR TIME-WEIGHTED AVERAGE LIMIT AS STATED IN 29 CFR 1910.1000 TABLE Z-A-1 FOR AIR CONTAMINANTS, SPECIFICALLY; SILICA; CRYSTALLINE QUARTZ (RESPIRABLE) 0.1 mg/m3.
IRRITANT TO EYES, NOSE AND LUNGS; PROLONGED INHLATION OF DUST MAY RESULT IN LUNG INJURY.

EMERGENCY AND FIRST AID PROCEDURES

FLUSH ALL AREAS CONTACTED WITH RUNNING WATER. IF IRRITATION PERSISTS, CONTACT PHYSICIAN.
INGESTION: DRINK WATER. DO NOT INDUCE VOMITING.
INHALATION: REMOVE TO FRESH AIR. IF BREATHING IS DIFFICULT, GIVE OXYGEN. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. GET MEDICAL ATTENTION.

VI. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
NONE

INCOMPATIBILITY
STRONG OXIDIZERS

HAZARDOUS DECOMPOSITION PRODUCTS
BURNING MAY RELEASE OXIDES OF CHLORINE

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
NOT APPLICABLE

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
SWEEP UP AND HOLD FOR DISPOSAL. FLUSH SPILL AREA WITH WATER.

NEUTRALIZING CHEMICALS
NA

WASTE DISPOSAL METHOD
DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS.

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS
MECHANICAL, GENERAL ROOM VENTILATION.
USE LOCAL VENTILATION TO MAINTAIN TLV (SEE SECTION V)

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY
USE A NIOSH APPROVED MECHANICAL RESPIRATOR FOR NONTOXIC DUSTS.

EYE
GOGGLES, IF EXTREMELY DUSTY CONDITIONS

GLOVES
GENERAL DUTY WORK GLOVES

OTHER CLOTHING AND EQUIPMENT
APRON, EYEWASH STATION

IX. SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

AVOID PROLONGED INHALATION.
USE WITH ADEQUATE VENTILATION.
RECOMMENDED LABEL FOR SACKS:
FRONT PANEL:
CAUTION
SEE BACK PANEL FOR CAUTION BEFORE USE.
BACK PANEL:
CAUTION
THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBITED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. PROLONGED INHALATION OF THE POWDER MAY RESULT IN SILICOSIS, A NONCANCEROUS LUNG DISEASE. AVOID CREATING DUSTY CONDITIONS AND USE A NIOSH APPROVED DUST RESPIRATOR.

OTHER HANDLING AND STORAGE REQUIREMENTS

STORE IN SHELTERED AREA OR COVER FOR MOISTURE PROTECTION

X. DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME :
NOT REGULATED

PLACARDS :
NONE

HAZARD CLASS :
NONE

REPORTABLE QUANTITY :
NONE

HAZARDOUS SUBSTANCE :
NONE

ID NUMBER :
NONE

LABEL :
NONE

Prepared by:
Environmental Services

DATE:
September.1991

XI. REGULATORY INFORMATION

STATUS ON SUBSTANCE LISTS

Comprehensive Environmental Response, Compensation and Liability Act of 1980, (CERCLA) requires notification of the National Response Center of release of quantities of Hazardous Substances equal to or greater than the reportable quantities (RQs) in 40 CFR 302.4.

Components present in this product which may require notification are:

Chemical	CAS Number
NONE	

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on RQs.
Components present in this product at a level which could require reporting under the statute are:

NONE

SARA requires the submission of annual reports of toxic chemicals that appear in 40 CFR 372 (for SARA 313). This information must be included in all MSDS that are copied and distributed for this material.
Components present in this product at a level which could require reporting under the statute are:

NONE

Toxic Substances Control Act (TSCA)
The ingredients of this product are on the TSCA inventory.

XII. STATE RIGHT TO KNOW

NOT ON ANY LISTS

Prepared by:
Environmental Services

DATE:
September.1991

IV. FIRE AND EXPLOSION DATA

NO FIRE OR EXPLOSION HAZARD. ZEOGEL WILL NOT SUPPORT COMBUSTION.
FIRE EXTINGUISHING MEDIA: WATER
SPECIAL FIREFIGHTING PROCEDURES: NONE

V. HEALTH HAZARD INFORMATION

CARCINOGENICITY - SEE ROUTES OF EXPOSURE AND EFFECTS (BELOW)

ACUTE ORAL LD50	ACUTE DERMAL LD50	AQUATIC TOXICITY LC50
ND	ND	23,500 ppm

ROUTES OF EXPOSURE AND EFFECTS

THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBITED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. NUISANCE DUST TLV = 10 mg/m3. OSHA PEL: CLASSIFIED AS A NUISANCE DUST WHEN LESS THAN 1% CRYSTALLINE SILICA IS PRESENT. IF GREATER THAN 1% CRYSTALLINE SILICA, THEN EXPOSURES SHALL NOT EXCEED AN 8-HOUR TIME-WEIGHTED AVERAGE LIMIT AS STATED IN 29 CFR 1910.1000 TABLE Z-1-A FOR AIR CONTAMINANTS, SPECIFICALLY; SILICA; CRYSTALLINE QUARTZ (RESPIRABLE) 0.1 mg/m3.
IRRITANT TO EYES, NOSE, THROAT AND LUNGS.

EMERGENCY AND FIRST AID PROCEDURES

RINSE ALL CONTACTED AREAS AFTER USE.

VI. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
STABLE

INCOMPATIBILITY
NONE

HAZARDOUS DECOMPOSITION PRODUCTS
NONE

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
WILL NOT OCCUR

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
VACUUM UP, SALVAGE USABLE MATERIAL. AVOID CREATING DUSTY CONDITIONS.

NEUTRALIZING CHEMICALS
NA

WASTE DISPOSAL METHOD
DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS
MECHANICAL, GENERAL ROOM VENTILATION
USE LOCAL VENTILATION TO MAINTAIN TLV (SEE SECTION V)

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY
USE A NIOSH APPROVED MECHANICAL FILTER RESPIRATOR FOR NONTOXIC DUSTS

EYE
GOGGLES, IF DESIRED

GLOVES
REGULAR DUTY WORK GLOVES

OTHER CLOTHING AND EQUIPMENT
APRON, EYEWASH STATION

IX. SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

AVOID PROLONGED INHALATION.
RECOMMENDED LABELING:
FRONT PANEL: CAUTION
SEE BACK PANEL FOR CAUTION BEFORE USE.
BACK PANEL: CAUTION
THIS PRODUCT CONTAINS FREE CRYSTALLINE SILICA WHICH ACCORDING TO THE IARC HAS EXHIBITED LIMITED EVIDENCE OF CARCINOGENICITY IN HUMANS. PROLONGED INHALATION OF THE POWDER MAY RESULT IN SILICOSIS. A NONCANCEROUS LUNG DISEASE. AVOID CREATING DUSTY CONDITIONS AND USE A NIOSH APPROVED DUST RESPIRATOR.

OTHER HANDLING AND STORAGE REQUIREMENTS

STORE IN SHELTERED AREA, OR COVER FOR MOISTURE PROTECTION.

X. DEPARTMENT OF TRANSPORTATION INFORMATION

PROPER SHIPPING NAME :
NOT REGULATED

PLACARDS :
NONE

HAZARD CLASS :
NOT HAZARDOUS

REPORTABLE QUANTITY :
NONE

HAZARDOUS SUBSTANCE :
NONE

ID NUMBER :
NONE

LABEL :
NONE REQUIRED

Prepared by:
Environmental Services

DATE:
July,1992

XI. REGULATORY INFORMATION

STATUS ON SUBSTANCE LISTS

Comprehensive Environmental Response, Compensation and Liability Act of 1980, (CERCLA) requires notification of the National Response Center of release of quantities of Hazardous Substances equal to or greater than the reportable quantities (RQs) in 40 CFR 302.4.

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Chemical	CAS Number
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Components present in this product at a level which could require reporting under the statute are:

NONE

Toxic Substances Control Act (TSCA)
The ingredients of this product are on the TSCA inventory.

XII. STATE RIGHT TO KNOW

NOT ON IN ANY LISTS.

Prepared by:
Environmental Services

DATE:
July,1992

LEHIGH PORTLAND CEMENT COMPANY

CORPORATE OFFICE

OSHA 29CFR 1910.1200

January 1991

Material Safety Data Sheet

for

Grout Cements

Section I-Identity

Manufacturer's name and address: Lehigh Portland Cement Company
P.O. Box 1882
Allentown, PA 18105

Emergency Telephone Number: (215) 776-2650

Chemical Name and Synonyms: Grout Cement (CAS #65997-15-1)
Hydraulic Cement

Trade Name and Synonyms: Lehigh Geocem

Section II-Chemical Data

Chemical family: Calcium Salts

Formula: Grout cement consists of finely ground portland cement clinker and limestone. Portland cement clinker is a sintered material produced by heating to high temperature (greater than 1200 degrees Celsius) a mixture of substances such as limestone and shale from the earth's crust. The substances manufactured are essentially hydraulic calcium silicates contained in a crystalline mass, not separable into the individual components.

Substances similar to the following are known to be present in portland cement:

$3CaO.SiO_2$	(CAS # 12168-85-3)
$2CaO.SiO_2$	(CAS # 10034-77-2)
$3CaO.Al_2O_3$	(CAS # 12042-78-3)
$4CaO.Al_2O_3.Fe_2O_3$	(CAS # 12068-35-8)

Small amounts of CaO, MgO, K_2SO_4, Na_2SO_4 may also be present.

718 HAMILTON MALL • P.O. BOX 1882 • ALLENTOWN, PA 18105-1882 • 215/776-2600 • FAX 215/776-2684 • TWX 510-651-1020

LEHIGH

Section III-Hazardous Ingredients

Ingredients: Portland cements are listed by OSHA in 29 CFR 1010.1000, Table Z-1-A, and require material safety data sheets (FR,January 19, 1989). MSHA (30 CFR 55.5.-1, Ref. 2), ACGIH (TLV's for 1973, Appendix E) and ACGIH (TLV's for 1984-5, Appendix D) list portland cements as nuisance dusts. Portland Cements are NOT listed by NTP, IARC, OR OSHA as carcinogens. However, since portland cement is manufactured from raw materials mined from the earth (limestone, marl, sand, shale, clay, etc.) and process heat is provided by burning fossil fuels, trace, but detectable, amounts of naturally occurring, and possible harmful, elements may be found during chemical analysis. Under ASTM standards, portland cement may contain .75 percent insoluble residue. A fraction of these residues may be free crystalline silica.

California & New Jersey Residents see attachment

Section IV-Physical Data

Boiling Point: Not applicable, grout cement is a powdered solid.

Vapor Pressure: Not applicable, grout cement is a powdered solid.

Vapor Density: Not applicable, grout cement is a powdered solid.

Solubility in Water: Slight (0.1-1.0%)

Specific Gravity: (H_2O=1) 2.88

Evaporation Rate: Not applicable, grout cement is a powdered solid.

Appearance and Odor: Gray powder; no odor.

Melting Point: Not applicable.

Section V-Fire and Explosion Hazard Data

Flash Point: Grout cement is noncombustible and not explosive.

Flammable or Explosive Limits: Not applicable.

Extinguishing Media: Not applicable.

Special Firefighting Procedures: Not applicable.

Unusual Fire and Explosion Hazards: None.

Lower Explosive Limit: Not applicable.

Upper Explosive Limit: Not applicable.

Section VI-Health Hazard Data

ACGIH Threshold Limit Value (1988-89):	Total dust containing no asbestos and less than 1% silica - 10 mg/m^3
OSHA PEL (Transitional):	Total dust - 50 million particles/ft^3
OSHA PEL (Final):	Total dust - 10 mg/m^3 Respirable dust - 5 mg/m^3

Effects of Overexposure:

Acute: Grout cement when dry is non-hazardous. When in contact with moisture (such as in eyes or on skin) or when mixed with water to make concrete, mortar, or grout it becomes highly caustic and will burn (as severely as third-degree) the eyes or skin. Inhalation of dry portland cement can irritate the upper respiratory system.

Chronic: Cement dust can cause inflammation of the lining tissue of the interior of the nose and inflammation of the cornea. Hypersensitive individuals may develop an allergic dermatitis. (Cement may contain trace (less than 0.05%) amounts of chromium salts or compounds including hexavalent chromium, or other metals found to be hazardous or toxic in some chemical forms. These metals are mostly present as trace substitutions within the principal minerals.)

Emergency and First Aid Procedures: Flush eyes immediately and repeatedly with water and seek prompt medical attention. Wash exposed skin areas with soap and water. If irritation or inflammation occurs seek prompt medical attention.

Section VII-Reactivity Data

Stability: Product is stable. Keep dry until used.

Incompatibility: Aluminum powder and other alkali and alkaline earth elements will react in wet mortar or concrete, liberating hydrogen gas.

Hazardous Decomposition Products: None

Hazardous Polymerization: Will not occur.

Section VIII-Spill Procedures

Steps to be taken in case material is spilled: Use dry cleanup methods that do not disperse the dust into the air. Avoid breathing the dust. Emergency procedures are not required.

Disposal Method: Small amounts of material can be disposed of as common waste or returned to the container for later use if not contaminated. Large volumes may require special handling.

Section IX-Special Protection Information

Respiratory Protection: Use a MSHA/NIOSH approved respirator in dusty enviroments.

Ventilation: Local exhaust can be used to control airborne dust levels.

Eye Protection: Use tight fitting goggles in dusty environments, or when working in concrete construction.

Skin Protection: Use barrier creams, impervious, abrasion- and alkali-resistant gloves, boots and protective clothing to protect the skin from prolonged contact with wet cement in plastic concrete, mortar or slurries. Immediately after working with cement or cement-containing materials, workers should shower with soap and water.
Precautions must be taken. A cement burn occurs with very little warning as little heat is sensed by the skin.

Section X-Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
ft^3	Cubic foot
IARC	International Agency for Research on Cancer
m^3	Cubic meter
mg	Milligram
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
TLV's	Threshold Limit Values

Note: This material safety data sheet attempts to describe as accurately as possible the potential exposures associated with normal cement use. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. Users have the responsibility to evaluate and use this product safely and to comply with all applicable laws and regulations.

RWK:dam

CEMENT. MICRO MATRIX CEMENT. 2500 LBS. PAGE

MATERIAL SAFETY DATA SHEET DATE: 02-27-9
HALLIBURTON SERVICES REVISED DATE 08-06-
DUNCAN. OKLAHOMA 73536

EMERGENCY TELEPHONE: 405/251-3565 OR 405/251-3569
AFTER HOURS: 405/251-3760

* * * * * * * * * * * SECTION I - PRODUCT DESCRIPTION - * * * * * * * * * * *

CHEMICAL CODE: CEMENT. MICRO MATRIX CEMENT. 2500 LBS. PART NUMBER: 51600617
PKG QTY: 2500 LB BIG BAG APPLICATION: CEMENT
SERVICE USED: CEMENT

* * * * * * * * * * SECTION II - COMPONENT INFORMATION - * * * * * * * * * *

COMPONENT	PERCENT	TLV	PEL
CALCIUM SILICATE	> 60 %	10 MG/M3	10 MG/M3
CALCIUM ALUMINATE	< 60 %	2 MG/M3	2 MG/M3
SILICA. CRYSTALLINE--QUARTZ	< 1 %	0.1 MG/M3	0.1 MG/M3

* * * * * * * * * * * * * SECTION III - PHYSICAL DATA - * * * * * * * * * * * * *

PROPERTY	MEASUREMENT
APPEARANCE	GRAY SOLID POWDER
ODOR	ODORLESS
SPECIFIC GRAVITY (H2O=1)	3.000
BULK DENSITY	50.00 LB/CU.FT.
PH	12.4
SOLUBILITY IN WATER AT 20 DEG C. GMS/100ML H20	SLIGHTLY
BIODEGRADABILITY	N/A
PERCENT VOLATILES	0
EVAPORATION RATE(BUTYL ACETATE=1)	N/A
VAPOR DENSITY	N/A
VAPOR PRESSURE (MMHG)	N/A
BOILING POINT(760 MMHG)	N/A
POUR POINT	N/A
FREEZE POINT	N/A

* * * * * * * * * * SECTION IV - FIRE AND EXPLOSION DATA - * * * * * * * * * *

FLASH POINT N/A
AUTOIGNITION TEMPERATURE ND F / ND C
FLAMMABLE LIMITS (OZ. PER CU. FT.) LOWER N/A UPPER N/A

EXTINGUISHING MEDIA:
NONCOMBUSTIBLE
SPECIAL FIRE FIGHTING PROCEDURES:
NOT APPLICABLE.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
NO FIRE HAZARD.

* * * * * * * * * * * * SECTION V - HEALTH HAZARD DATA - * * * * * * * * * * * *

CALIFORNIA PROPOSITION 65:
PRODUCT OR PRODUCT COMPONENTS ARE REGULATED UNDER CALIF. PROPOSITION 65.

CARCINOGENIC DETERMINATION:

PRODUCT OR COMPONENTS ARE LISTED AS A POTENTIAL CARCINOGEN
ACCORDING TO' : IARC

PRODUCT TOXICITY DATA: NOT DETERMINED

PRODUCT TLV: 10 MG/M3(T). 5 MM/M3(R)

---------- EFFECTS OF EXPOSURE ----------

ROUTES OF EXPOSURE:
EYE OR SKIN CONTACT. INHALATION.
EYE:
DUST MAY CAUSE MODERATE TO SEVERE EYE IRRITATION WITH CORNEAL INJURY THAT MAY BE SLOW TO HEAL.
SKIN:
CEMENT DUST CAN BE IRRITATING TO SKIN. WET CEMENT CAN DRY THE SKIN AND CAUSE ALKALI BURNS. SENSITIVE INDIVIDUALS MAY DEVELOP ALLERGIC DERMATITIS.
INHALATION:
MAY BE IRRITATING.
TREAT AS NUISANCE DUST.
INGESTION:
NO DATA AVAILABLE
CHRONIC EFFECTS:
CRYSTALLINE SILICA IS NOT ON THE NTP OR OSHA CARCINOGEN LIST. IARC HAS DETERMINED THERE IS SUFFICIENT EVIDENCE FOR CARCINOGENICITY OF CRYSTALLINE SILICA TO EXPERIMENTAL ANIMALS AND LIMITED EVIDENCE TO HUMANS. "LIMITED EVIDENCE" MEANS POSSIBLE RELATIONSHIP. BUT OTHER FACTORS CANNOT BE EXCLUDED CONTAINS TRACE AMOUNTS OF ARSENIC. A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER. EXPOSURE TO ARSENIC SHOULD NOT EXCEED THE FEDERAL OSHA PEL UNLESS USED IN A MANNER THAT PRODUCES EXTREMELY HEAVY AIR-BORNE CONCENTRATIONS OF PRODUCT AT LEVELS WELL ABOVE THE ALLOWABLE LIMITS.
'THER SYMPTOMS AFFECTED:
BECAUSE OF ITS IRRITATING PROPERTIES. THIS MATERIAL MAY AGGRAVATE AN EXISTING DERMATITIS.

---------- EMERGENCY AND FIRST AID PROCEDURES ----------

EYE:
IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS. SEEK PROMPT MEDICAL ATTENTION.
SKIN:
PROMPTLY WASH SKIN WITH SOAP AND WATER. WASH CLOTHING BEFORE REUSE.
INHALATION:
REMOVE TO FRESH AIR. IF IRRITATION PERSISTS. SEEK MEDICAL ATTENTION.
INGESTION:
DO NOT INDUCE VOMITING! IN GENERAL. NO TREATMENT IS NECESSARY UNLESS LARGE QUANTITIES ARE INGESTED. HOWEVER. MEDICAL ADVICE SHOULD BE OBTAINED.

* * * * * * * * * * * * * SECTION VI - REACTIVITY DATA - * * * * * * * * * * * * *

STABILITY: STABLE
CONDITIONS TO AVOID:
STORE IN A DRY LOCATION.
INCOMPATIBILITY (MATERIALS TO AVOID):
NONE KNOWN.
HAZARD POLYMERIZATION: WON"T OCCUR
CONDITIONS TO AVOID:
NOT APPLICABLE.

* * * * * * * * * * SECTION VII - SPILL OR LEAK PROCEDURES - * * * * * * * * * *

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
USE PROTECTIVE EQUIPMENT. SWEEP UP AND REMOVE. AVOID CREATING OR INHALING DUST.
WASTE DISPOSAL METHOD:
IF NOT CONTAMINATED. REUSE PRODUCT.

GET APPROVAL FROM LANDFILL OPERATOR AND TRANSPORT TO SANITARY LANDFILL.

* * * * * * * * * SECTION VIII - SPECIAL PROTECTION INFORMATION - * * * * * *

RESPIRATORY PROTECTION (USE NIOSH/MSHA APPROVED EQUIPMENT):
TOXIC DUST/MIST RESPIRATOR.
VENTILATION:
USE ONLY WITH ADEQUATE VENTILATION.
PROTECTIVE GLOVES:
NORMAL WORK GLOVES.
EYE PROTECTION:
DUST PROOF GOGGLES.
OTHER PROTECTIVE EQUIPMENT:
NORMAL WORK COVERALLS.

* * * * * * * * * * * * * SECTION IX - SPECIAL PRECAUTIONS - * * * * * * * * * *

PRECAUTIONARY LABELING CEMENT. MICRO MATRIX CEMENT. 2500 LBS. 516.006120

WARNING!
CONTAINS A SMALL AMOUNT OF CRYSTALLINE SILICA. REPEATED OR PROLONGED
INHALATION OF DUST MAY CAUSE A DELAYED RESPIRATORY ILLNESS (SILICOSIS). TH
INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS DETERMINED THERE IS
LIMITED EVIDENCE OF THE CARCINOGENICITY OF CRYSTALLINE SILICA.
MAY CAUSE EYE AND SKIN IRRITATION.
MAY CAUSE SKIN BURNS IF CEMENT IS WET OR WITH CONFINED INTIMATE CONTACT.
FOR PRECAUTIONARY STATEMENTS. REFER TO SECTIONS IV-VIII.
OTHER HANDLING AND STORAGE CONDITIONS:
STORE IN DRY LOCATION TO PROTECT PRODUCT QUALITY.
AVOID CREATING OR INHALING DUST.
AVOID CONTACT WITH SKIN. EYES AND CLOTHING.
CONTAINER DISPOSITION:
EMPTY CONTAINER COMPLETELY. DISPOSE OF EMPTY CONTAINER IN SANITARY LANDFIL
BY FIRST OBTAINING LANDFILL OPERATOR'S AUTHORIZATION.

* * * * * * * * * * SECTION X - TRANSPORTATION INFORMATION - * * * * * * * * * *

DOT SHIPPING DESCRIPTION:
NOT RESTRICTED

* * * * * * * * * - SECTION XI ENVIRONMENTAL EVALUATION - * * * * * * * * * * *

EPA SUPERFUND(SARA) TITLE III - HAZARD CLASSIFICATION & ASSOCIATED INFORMATION
++

FIRE: N PRESSURE: N REACTION: N ACUTE (IMMEDIATE): Y CHRONIC (DELAYED): N

MIXTURE OR PURE MATERIAL	MIX
EPA - REPORTABLE SPILL QUANTITY	N/A
EXTREMELY HAZARDOUS LIST	NO

B. EPA - TOXIC CHEMICAL CONTENT AS LISTED IN 40 CFR PART 372

CHEMICAL CONTAINS NO TOXIC INGREDIENTS

C. NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS(NFPA 704)

HEALTH 1 FLAMMABILITY 0 REACTIVITY 0 SPECIAL NONE

D. COMPONENTS ARE LISTED ON FOLLOWING REGULATORY CHEMICAL INVENTORIES

TSCA YES CEPA NE EEC YES ACOIN YES

THE INFORMATION WHICH IS CONTAINED IN THIS DOCUMENT IS BASED UPON AVAILABLE DATA AND BELIEVED TO BE CORRECT. HOWEVER, AS SUCH HAS BEEN OBTAINED FROM VARIOUS SOURCES, INCLUDING THE MANUFACTURER AND INDENPENDENT LABORATORIES. IT IS GIVEN WITHOUT WARRANTY OR REPRESENTATION THAT IS COMPLETE, ACCURATE AND CAN BE RELIED UPON. HALLIBURTON HAS NOT ATTEMPTED TO CONCEAL IN ANY WAY THE DELETERIOUS ASPECTS OF THE PRODUCT LISTED HEREIN. BUT MAKES NO WARRANTY AS TO SUCH. FURTHER, AS HALLIBURTON CANNOT ANTICIPATE NOR CONTROL THE MANY SITUATIONS IN WHICH THE LISTED PRODUCT OR THIS INFORMATION MAY BE USED BY OUR CUSTOMER, THERE IS NO GUARANTEE THAT THE HEALTH AND SAFETY PRECAUTIONS SUGGESTED WILL BE PROPER UNDER ALL CONDITIONS. IT IS THE SOLE RESPONSIBILITY OF EACH USER OF THE LISTED PRODUCT TO DETERMINE AND COMPLY WITH THE REQUIREMENTS OF ALL APPLICABLE LAWS AND REGULATIONS REGARDING ITS USE. THIS INFORMATION IS GIVEN SOLELY FOR THE PURPOSES OF SAFETY TO PERSONS AND PROPERTY. ANY OTHER USE OF THIS INFORMATION IS EXPRESSLY PROHIBITED. GOVERNMENT REGULATIONS DEPARTMENT. HALLIBURTON SERVICES.

J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

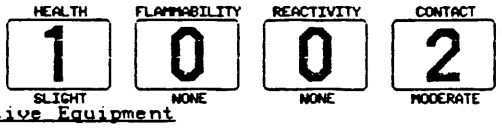
C0357 -01 Calcium Chloride, Anhydrous Page:
Effective: 09/26/85 Issued: 09/26/8

SECTION I - PRODUCT IDENTIFICATION

Product Name: Calcium Chloride, Anhydrous
Formula: $CaCl_2$
Formula Wt: 110.99
CAS No.: 10043-52-4
NIOSH/RTECS No.: EV9800000
Product Codes: 1311

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment

Precautionary Label Statements

STORAGE: Keep in tightly closed container.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Calcium Chloride	90-100	10043-52-4

SECTION III - PHYSICAL DATA

Boiling Point: N/A
Melting Point: 772°C (1422°F)
Specific Gravity: 2.15 (H_2O=1)
Solubility(H_2O): Complete (in all proportions)
Vapor Pressure(mmHg): N/A
Vapor Density(air=1): N/A
Evaporation Rate: N/A (Butyl Acetate=1)
% Volatiles by Volume: 0

Continued on Page: 2

SECTION III - PHYSICAL DATA (Continued)

Appearance & Odor: White granules.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Fire Extinguishing Media
Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures
Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

Toxic Gases Produced
hydrogen chloride

SECTION V - HEALTH HAZARD DATA

Toxicity: LD_{50} (oral-rat)(mg/kg) - 1000
LD_{50} (ipr-mouse)(mg/kg) - 280

Effects of Overexposure
Contact with skin or eyes may cause severe irritation or burns.
Ingestion may cause nausea and vomiting.
Dust may irritate nose and throat.

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: moisture

Incompatibles: most common metals, water

Decomposition Products: hydrogen chloride

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge
Wear self-contained breathing apparatus and full protective clothing. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

Disposal Procedure
Dispose in accordance with all applicable federal, state, and local environmental regulations.

Continued on Page: 3

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use adequate general or local exhaust ventilation to keep fume and dust levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator or dust mask.

Eye/Skin Protection: Safety glasses with sideshields, uniform, rubber gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: Orange

Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s.

INTERNATIONAL (I.M.O.)

Proper Shipping Name Chemicals, n.o.s.

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

-- LAST PAGE --

J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone – (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

SECTION I - PRODUCT IDENTIFICATION

Product Name: Calcium Chloride, Pellets
Formula: $CaCl_2$
Formula Wt: 110.99
CAS No.: 10043-52-4
NIOSH/RTECS No.: EV9800000
Product Codes: 1313

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
1	0	0	2
SLIGHT	NONE	NONE	MODERATE

Laboratory Protective Equipment

Precautionary Label Statements

STORAGE: Keep in tightly closed container.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Calcium Chloride	90-100	10043-52-4

SECTION III - PHYSICAL DATA

Boiling Point: N/A
Vapor Pressure(mmHg): N/A
Melting Point: 772°C (1422°F)
Vapor Density(air=1): N/A
Specific Gravity: 2.15 (H_2O=1)
Evaporation Rate: N/A (Butyl Acetate=1)
Solubility(H_2O): Complete (in all proportions)
% Volatiles by Volume: 0

Continued on Page: 2

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SECTION III - PHYSICAL DATA (Continued)

Appearance & Odor: White pellets.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Fire Extinguishing Media
Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures
Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

Toxic Gases Produced
hydrogen chloride

SECTION V - HEALTH HAZARD DATA

Toxicity: LD_{50} (oral-rat)(mg/kg) - 1000
LD_{50} (ipr-mouse)(mg/kg) - 280

Effects of Overexposure
Contact with skin or eyes may cause severe irritation or burns.
Ingestion may cause nausea and vomiting.
Dust may irritate nose and throat.

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: moisture

Incompatibles: most common metals, water

Decomposition Products: hydrogen chloride

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge
Wear self-contained breathing apparatus and full protective clothing. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

Disposal Procedure
Dispose in accordance with all applicable federal, state, and local environmental regulations.

Continued on Page: 3

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J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DAT SHEET

C0360 -01 Calcium Chloride, Pellets Page:
Effective: 10/25/85 Issued: 10/29/8

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation:	Use adequate general or local exhaust ventilation to keep fume or dust levels as low as possible.
Respiratory Protection:	None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator or dust mask.
Eye/Skin Protection:	Safety glasses with sideshields, uniform, rubber gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: Orange

Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s.

INTERNATIONAL (I.M.O.)

Proper Shipping Name Chemicals, n.o.s.

N/A = Not Applicable or Not Available

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aldrich chemical co., inc.

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ATTN: SAFETY DIRECTOR
HENRY TATUM
U S ARMY ENGINEERS
ATTN FINANCE & ACCOUNTING OFFICER
3909 HALLS FERRY RD
VICKSBURG MS 39180-6133

DATE: 08/25/92
CUST#: 580031
PO#:

MATERIAL SAFETY DATA SHEET PAGE 1

IDENTIFICATION

PRODUCT #: 37266-8 NAME: CALCIUM SILICATE, -200 MESH, 99%
CAS #:1344-95-2
MF: CAO3SI

SYNONYMS
CALCIUM HYDROSILICATE * CALCIUM MONOSILICATE * CALCIUM POLYSILICATE * CALCIUM SILICATE * CALCIUM SILICATE (OSHA) * CALFLO E * CALSIL * CS LAFARGE * FLORITE R * MARIMET 45 * MICROCAL 160 * MICROCAL ET * MICRO-CEL * MICRO-CEL A * MICRO-CEL B * MICRO-CEL C * MICRO-CEL E * MICRO-CEL T * MICRO-CEL T26 * MICRO-CEL T38 * MICRO-CEL T41 * PROMAXON P60 * SILENE EF * SILMOS T * SOLEX * STABINEX NW 7PS * STARLEX L * SW 400 * TOYOFINE A *

TOXICITY HAZARDS

RTECS NO: VV9150000
SILICIC ACID, CALCIUM SALT
REVIEWS, STANDARDS, AND REGULATIONS
ACGIH TLV-TWA 10 MG/M3 (TOTAL DUST) 85INA8 5,92.1(89),86
OSHA PEL:8H TWA 15 MG/M3, TOTAL DUST FEREAC 54,2923,89
OSHA PEL:8H TWA 5 MG/M3, RESPIRABLE FRACTION FEREAC 54,2923,89
OSHA PEL FINAL:8H TWA 15 MG/M3, TOTAL DUST FEREAC 54,2923,89
OSHA PEL FINAL:8H TWA 5 MG/M3, RESPIRABLE FRACTION FEREAC 54,2923,89
NOES 1983: HZD X1322; NIS 83; TNF 6757; NOS 65; TNE 103864; TFE 16592
EPA TSCA CHEMICAL INVENTORY, JUNE 1990

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

HEALTH HAZARD DATA

ACUTE EFFECTS
MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION.
CAUSES EYE IRRITATION.
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES.
IN CASE OF CONTACT, IMMEDIATELY WASH SKIN WITH SOAP AND COPIOUS AMOUNTS OF WATER.

CONTINUED ON NEXT PAGE

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CUST#: 580031
PO#:

PRODUCT #: 37266-8 NAME: CALCIUM SILICATE, -200 MESH, 99%
CAS #:1344-95-2
MF: CAO3SI

---------- HEALTH HAZARD DATA ----------

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

---------- PHYSICAL DATA ----------

SPECIFIC GRAVITY: 2.900
APPEARANCE AND ODOR
WHITE POWDER

---------- FIRE AND EXPLOSION HAZARD DATA ----------

EXTINGUISHING MEDIA
WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
SPECIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
UNUSUAL FIRE AND EXPLOSIONS HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

---------- REACTIVITY DATA ----------

INCOMPATIBILITIES
STRONG OXIDIZING AGENTS
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
SILICON OXIDE

---------- SPILL OR LEAK PROCEDURES ----------

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
WEAR RESPIRATOR, CHEMICAL SAFETY GOGGLES, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.

CONTINUED ON NEXT PAGE

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CUST#: 580031
PO#:

PRODUCT #: 37266-8 NAME: CALCIUM SILICATE, -200 MESH, 99%
CAS #:1344-95-2
MF: CA03SI

---------- SPILL OR LEAK PROCEDURES ----------

AVOID RAISING DUST.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

WASTE DISPOSAL METHOD
DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

CHEMICAL SAFETY GOGGLES.
COMPATIBLE CHEMICAL-RESISTANT GLOVES.
NIOSH/MSHA-APPROVED RESPIRATOR.
SAFETY SHOWER AND EYE BATH.
MECHANICAL EXHAUST REQUIRED.
DO NOT BREATHE DUST.
AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
WASH THOROUGHLY AFTER HANDLING.
IRRITATING DUST.
KEEP TIGHTLY CLOSED.
STORE IN A COOL DRY PLACE.

LABEL PRECAUTIONARY STATEMENTS
IRRITANT
IRRITATING TO EYES AND RESPIRATORY SYSTEM.
IRRITATING DUST.
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
DO NOT BREATHE DUST.
WEAR SUITABLE GLOVES AND EYE/FACE PROTECTION.

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J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone – (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

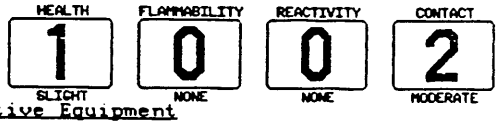
S4970 -01 Sodium meta-Silicate, 9-Hydrate, Crystal
Effective: 09/27/85 Issued: 09/30/8

SECTION I - PRODUCT IDENTIFICATION

Product Name: Sodium meta-Silicate, 9-Hydrate, Crystal
Formula: Na_2SiO_3 $9H_2O$
Formula Wt: 284.20
CAS No.: 06834-92-0
Product Codes: 3868

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment

Precautionary Label Statements

WARNING!
CAUSES IRRITATION
Avoid contact with eyes, skin, clothing.
Keep in tightly closed container. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Sodium meta-Silicate, 9-Hydrate	90-100	6834-92-0

SECTION III - PHYSICAL DATA

Boiling Point:	N/A	Vapor Pressure(mmHg):	N/A
Melting Point:	N/A	Vapor Density(air=1):	N/A
Specific Gravity: (H_2O=1)	0.00	Evaporation Rate: (Butyl Acetate=1)	N/A

Continued on Page: 2

SECTION III - PHYSICAL DATA (Continued)

Solubility(H_2O): Appreciable (more than 10 %) % Volatiles by Volume: 0

Appearance & Odor: White platelets.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Ingestion may cause gastrointestinal pain.

Emergency and First Aid Procedures

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: none documented

Incompatibles: fluorine

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use adequate general or local exhaust ventilation to keep fume and dust levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is

Continued on Page: 3

S4970 -01 Sodium meta-Silicate, 9-Hydrate, Crystal Page:
Effective: 09/27/85 Issued: 09/30/8

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT (Continued)

high, use an appropriate respirator or dust mask.

Eye/Skin Protection: Safety glasses with sideshields, uniform, proper gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: Orange

Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s.

INTERNATIONAL (I.M.O.)

Proper Shipping Name Chemicals, n.o.s.

N/A = Not Applicable or Not Available

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-- LAST PAGE --

J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

S4982 -01 Sodium Silicate Solution Page:
Effective: 10/24/85 Issued: 10/25/8

SECTION I - PRODUCT IDENTIFICATION

Product Name: Sodium Silicate Solution
Formula: $Na_2O(SiO_2)_x (H_2O)_y$
Formula Wt: .00
CAS No.: 01344-09-8
Common Synonyms: Water Glass; Soluble Glass; Silicate of Soda
Product Codes: 5135,3877

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
1	0	0	2
SLIGHT	NONE	NONE	MODERATE

Laboratory Protective Equipment

Precautionary Label Statements

WARNING!
CAUSES IRRITATION
Avoid contact with eyes, skin, clothing.
Keep in tightly closed container. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Sodium Silicate	35-40	1344-09-8

SECTION III - PHYSICAL DATA

Boiling Point: 102°C (216°F)
Melting Point: N/A
Specific Gravity: 1.30 (H_2O=1)
Vapor Pressure(mmHg): 18
Vapor Density(air=1): N/A
Evaporation Rate: N/A (Butyl Acetate=1)

Continued on Page: 2

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SECTION III - PHYSICAL DATA (Continued)

Solubility(H_2O): Complete (in all proportions) % Volatiles by Volume: 70-80

Appearance & Odor: Colorless, turbid liquid with no odor or slightly soapy odor

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Fire Extinguishing Media
Use extinguishing media appropriate for surrounding fire.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure
Contact with skin or eyes may cause irritation.

Emergency and First Aid Procedures
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Incompatibles: mineral acids, organic acids, most common metals, organic materials

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge
Wear suitable protective clothing. Take up with sand or other noncombustible absorbent material and place into container for later disposal. Flush spill area with water.

Disposal Procedure
Dispose in accordance with all applicable federal, state, and local environmental regulations.

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use adequate general or local exhaust ventilation to keep vapor and mist levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator or dust mask.

Continued on Page: 3

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT (Continued)

Eye/Skin Protection: Safety goggles, uniform, apron, rubber gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: Orange

Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s.

INTERNATIONAL (I.M.O.)

Proper Shipping Name Chemicals, n.o.s.

N/A = Not Applicable or Not Available

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-- LAST PAGE --

MATERIAL SAFETY DATA SHEET - "A" SIDE
(Base resin-packaged 5-gallon pail or drum)

MANUFACTURER/DISTRIBUTOR:
GREEN MOUNTAIN, INC.
(708) 629-2653
4 N 250 ROUTE 53
ADDISON, ILLINOIS 60101

CHEMICAL NAME/LABEL:
MOUNTAIN GROUT "A" SIDE
(INCLUDES BELOW FORMULATIONS)
REG, FLEX, SOIL STAB, LOW VISC.
CHEMICAL WATER CUT-OFF GROUT

SECTION II CHEMICAL AND PHYSICAL PROPERTIES

HAZARDOUS DECOMPOSITION PRODUCTS: Orides of Carbon and Nitrogen.
INCOMPATIBILITY (KEEP AWAY FROM): Water,(MOISTURE),ALCOHOLS, amines,strong acids and bases.
TOXIC AND HAZARDOUS INGREDIENTS: Polymeric, Methylene Diphenyl Isocyanate (MDI), Toluene Diisocyanate Free Isocyanate (TDI), Polyether Prepolymer

FORM: Liquid
APPEARANCE: Viscous Liquid
SPECIFIC GRAVITY: 1.106
MELTING POINT: NDA
REACTS WITH WATER
EVAPORATION RATE: NIL
VAPOR DENSITY > 1
PH:NDA
VISCOSITY AT 100 F: NDA

ODOR: Aromatic Odor
COLOR:Dark Brown
BOILING POINT: > 207 C
> 406 F
% VOLATILE (BY WT%): NIL
VAPOR PRESSURE (mm Hg at 20 C):
< 0.000005
STABILITY: Stable
VISCOSITY AT 25 C:NDA

SECTION III FIRE AND EXPLOSION DATA

SPECIAL FIRE FIGHTING PROCEDURES: Fire fighters must be equipped to prevent breathing of vapors or products of combustion. Must wear self-contained breathing apparatus.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Avoid moisture contamination in closed containers. Reaction with moisture will generate CO 2 which may rupture the container.
FLASH POINT:(METHOD USED C.O.C.) NDA
EXTINGUISHING AGENTS: Dry chemical, CO 2, waterspray, foam.

SECTION IV HEALTH HAZARD DATA

PERMISSIBLE CONCENTRATIONS AIR: Methylene Diphenyl Isocyanate (MDI)
OSHA PEL 0.02 (c) ppm, ACGIH TWA 0.005 ppm
EFFECTS OF OVEREXPOSURE: Irritant to eyes & respiratory tract. May cause headaches, nausea, coughing, shortness of breath, chest pains. May result in respiratory distress.
TOXICOLOGICAL PROPERTIES: May cause allergic skin or respiratory reaction. Persons with known respiratory allergies should avoid exposure to this product.
EMERGENCY FIRST AID PROCEDURES:
Eyes:
Flush with plenty of water for at least 15 minutes. Call a physician.
Skin Contact:
Wash thoroughly with soap and water. Remove contaminated clothing and discard contaminated shoes. Wash clothing before re-use.
Inhalation:
Remove from contaminated area to a fresh air supply. Call a physician victim is not breathing, give artificial respiration. If breathing is difficult, give oxygen.
If Swallowed: Call a Physician immediately.

SECTION V SPECIAL PROTECTION INFORMATION

VENTILATION TYPE REQUIRED:Mechanical general/local exhaust ventilation control vapor or mists below maximum exposure limits.
RESPIRATORY PROTECTION:Use only NIOSH approved apparatus.
PROTECTIVE GLOVES:Use impervious rubber or plastic.
EYE PROTECTION: Use safety goggles and face shield to avoid splashing face.

SECTION VI HANDLING OF SPILLS OR LEAKS

PROCEDURES FOR CLEAN-UP:With adequate ventilation, cover with an inert absorbent material such as clay or vermiculite, transfer to metal container. Saturate with water but DO NOT SEAL THE CONTAINER (CO 2 will generated). Wash the area with water containing 5% ammonia and detergent Wear respirator and other protective equipment for protection of eyes and skin during clean-up.
WASTE DISPOSAL:Distributor/Manufacturer is not responsible for disposal containers.Buyer must dispose of consistent with Federal, State, and local regulations.

SECTION VII SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:Avoid contact with moisture. Contamination by moisture or water may cause material to react and generate CO 2 which will rupture sealed containers. Store between and 85 degrees F. (16 and 30 degrees C)

SECTION VIII TRANSPORTATION DATA

UNREGULATED BY D.O.T.
U.S.D.O.T. PROPER SHIPPING NAME:NA
U.S.D.O.T. HAZARD CLASS:None
I.D. NUMBER: NONE
LABELS REQUIRED:None for domestic transportation.
FREIGHT CLASSIFICATION: Liquid Plastic Material/NOIBN
TRANSPORTATION EMERGENCY INFORMATION: CHEM TREC 1-800-424-9300

SECTION IX PRECAUTIONARY COMMENTS

THE FOAM PRODUCED IS AN ORGANIC MATE AND MUST BE CONSIDERED AS COMBUSTIBLE. THE FOAM MUST NOT BE LEFT EXPOS OR UNPROTECTED. SHIELD THE FOAM FROM HEAT OR SPARKS WITH A THERMAL BARRIER.

GREEN MOUNTAIN, INC. IS A MARKETING AGENCY. ANY AND ALL DATA PROVIDED F GREEN MOUNTAIN, INC. COMES DIRECTLY FROM THE CHEMICAL MANUFACTURERS THA SUPPLY GREEN MOUNTAIN WITH PRODUCT. THE USER MUST DETERMINE THE ACCURA AND COMPLETENESS OF SUCH INFORMATION AND THE APPROPRIATENESS OF THE MATERIAL FOR THE USERS APPLICATION.
WE BELIEVE THE STATEMENTS, TECHNICAL INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE RELIABLE, BUT THEY ARE GIVEN WITHOUT WARRANTY OR GUARANTEE OF ANY KIND, EXPRESS OR IMPLIED, AND WE ASSUME NO RESPONSIBIL FOR ANY LOSS, DAMAGE, OR EXPENSE, DIRECT OR CONSEQUENTIAL, ARISING OUT THEIR USE.

MATERIAL SAFETY DATA SHEET - "B" SIDE
(CATALYST- packaged in pints or 1-gallon cans)

MANUFACTURER/DISTRIBUTOR:
GREEN MOUNTAIN, INC.
4 N 250 ROUTE 53
ADDISON, ILLINOIS 60101

CHEMICAL NAME/LABEL:
MOUNTAIN GROUT (polyurethane)
PURE CATALYST
CHEMICAL WATER CUT-OFF GROUT

SECTION II CHEMICAL AND PHYSICAL PROPERTIES

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of Carbon and Nitrogen.
INCOMPATIBILITY (KEEP AWAY FROM):Reacts with Isocyanates
TOXIC AND HAZARDOUS INGREDIENTS: Amine Catalyst <10%
FORM: Liquid — ODOR: Amine
APPEARANCE: Viscous Liquid — COLOR: Amber
SPECIFIC GRAVITY: .93 @ 20 C — BOILING POINT: > 149 C
MELTING POINT: NDA — > 300 F
Solubility in water: slight at 25 C — % VOLATILE (BY WT%): NIL
EVAPORATION RATE: NIL — VAPOR PRESSURE (mm Hg at 20 C):
VAPOR DENSITY > 1 — Not applicable
PH:NDA — STABILITY: Stable
VISCOSITY AT 100 F: NDA — VISCOSITY AT 20 C: 30 cps

SECTION III FIRE AND EXPLOSION DATA

SPECIAL FIRE FIGHTING PROCEDURES: Fire fighters must be equipped to prevent breathing of vapors or products of combustion. Must wear self-contained breathing apparatus.
UNUSUAL FIRE AND EXPLOSION HAZARDS: NDA
FLASH POINT:(METHOD USED C.O.C.) NDA
EXTINGUISHING AGENTS: Dry chemical, CO 2, waterspray, foam.

SECTION IV HEALTH HAZARD DATA

PERMISSIBLE CONCENTRATIONS AIR: NDA
EFFECTS OF OVEREXPOSURE: Irritant to eyes & respiratory tract.
TOXICOLOGICAL PROPERTIES: NDA
EMERGENCY FIRST AID PROCEDURES:
Eyes:
Flush with plenty of water for at least 15 minutes. Call a physician.
Skin Contact:
Wash thoroughly with soap and water. Remove contaminated clothing and discard contaminated shoes. Wash clothing before re-use.
Inhalation:
Remove from contaminated area to a fresh air supply. Call a physician. If victim is not breathing, give artificial respiration. If breathing is difficult, give oxygen.
If Swallowed: Call a Physician immediately.

SECTION V SPECIAL PROTECTION INFORMATION

VENTILATION TYPE REQUIRED:Mechanical general/local exhaust ventilation control vapor or mists below maximum exposure limits.
RESPIRATORY PROTECTION:Use only NIOSH approved apparatus.
PROTECTIVE GLOVES:Use impervious rubber or plastic.
EYE PROTECTION: Use safety goggles and face shield to avoid splashing o face.

SECTION VI HANDLING OF SPILLS OR LEAKS

PROCEDURES FOR CLEAN-UP:With adequate ventilation, cover with an inert absorbent material such as clay or vermiculite, transfer to a waste container. Wash the area with water and detergent. Wear protective equipment for protection of eyes and skin during clean-up.
WASTE DISPOSAL:Distributor/Manufacturer is not responsible for disposal containers.Buyer must dispose of containers consistent with Federal, St and local regulations.

SECTION VII SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Store between 60 and degrees F. (16 and 30 degrees C)

SECTION VIII TRANSPORTATION DATA

UNREGULATED BY D.O.T. — U.S.D.O.T. PROPER SHIPPING NAME:NA
U.S.D.O.T. HAZARD CLASS:None — I.D. NUMBER: NONE
LABELS REQUIRED:None for domestic transportation.
FREIGHT CLASSIFICATION: Resin Compound Class # 55 Item No. 46030
TRANSPORTATION EMERGENCY INFORMATION: CHEM TREC 1-800-424-9300

SECTION IX PRECAUTIONARY COMMENTS : THE FOAM PRODUCED IS AN ORGANIC MATERIAL AND MUST BE CONSIDERED AS COMBUSTIBLE. THE FOAM MUST NOT BE L EXPOSED OR UNPROTECTED. SHIELD THE FOAM FROM HEAT OR SPARKS WITH A THE BARRIER.

REVISION DATE: 11/8/89
GREEN MOUNTAIN, INC. IS A MARKETING AGENCY. ANY AND ALL DATA PROVIDED B GREEN MOUNTAIN, INC. COMES DIRECTLY FROM THE CHEMICAL MANUFACTURERS THA SUPPLY GREEN MOUNTAIN WITH PRODUCT. THE USER MUST DETERMINE THE ACCURA AND COMPLETENESS OF SUCH INFORMATION AND THE APPROPRIATENESS OF THE MATERIAL FOR THE USERS APPLICATION.
WE BELIEVE THE STATEMENTS, TECHNICAL INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE RELIABLE, BUT THEY ARE GIVEN WITHOUT WARRANTY OR GUARANTEE OF ANY KIND, EXPRESS OR IMPLIED, AND WE ASSUME NO RESPONSIBIL FOR ANY LOSS, DAMAGE, OR EXPENSE, DIRECT OR CONSEQUENTIAL, ARISING OUT THEIR USE.

POTABLE WATER COMPATIBILITY AND THE EPA

H.H. HOLMES TESTING LABORATORIES, INC.

Report No. 1 • 170 Shepard Avenue • Wheeling, Illinois 60090 • Area Code 312 • 541-404(

October 3, 1990

Lab No. CH 5929
File No. 8069.0

Green Mountain, Inc.
4 N 250 Rte. 53
Addison, IL 60101

Dear Sirs:

At your request a sample of Mountain Grout® (Regular) was molded and placed in a distilled water bath for twenty-eight (28) days. There was no leaking of any chemical in the distilled water at the end of seven or twenty-eight days.

We feel that the Mountain Grout® that is used to repair and waterproof the concrete structure is not harmful to potable water.

Hoping to have been of service, we remain,

Respectfully submitted,

Richard E. Nelson, Jr.
President

REN/pbn

ENVIRONMENTAL PROTECTION AGENCY NOTICE

NOTE: As of July 7, 1988, the EPA no longer approves or disapproves the effects of substances which come into contact with potable water. See the "Federal Register" of that date entitled "Part IV Environmental Protection Agency, drinking water technical assistance: termination of the federal drinking water additives program notice".

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U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NUMBER
DE NEEF AMERICA INC.	(517) 681-5791
ADDRESS (Number, Street, City, State and Zip Code)	
122 North Mill Street - St. Louis, Michigan 48880	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS
	TACSS 020 NF/TACSS 025 NF
CHEMICAL FAMILY	FORMULA
Polyurethanes/Polyisocyanates	

SECTION II — HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES AND SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Polyurethanes containing free isocyanate groups	100	

SECTION III — PHYSICAL DATA

BOILING POINT (°F) Decomp.	260° C	SPECIFIC GRAVITY (H_2O = 1)	1,1 - 1,2
VAPOR PRESSURE (mm Hg.) 150° C	1,4	PERCENT, VOLATILE BY VOLUME (%)	0
VAPOR DENSITY (AIR = 1)	8,5	EVAPORATION RATE	<1
SOLUBILITY IN WATER	insoluble		
APPEARANCE AND ODOR Brown liquid			

SECTION IV — FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) C.O.C. 160° C	FLAMMABLE LIMITS	LEL	UEL
EXTINGUISHING MEDIA Water fog - "CO2" - Dry chemical			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

PAGE (1) (Continued on reverse side) FORM OSHA-20 Rev. May '72

SECTION V — HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Not established

EFFECTS OF OVEREXPOSURE
Liquid: Irritating to skin and eyes

Vapors: Irritating to eyes and lungs

EMERGENCY AND FIRST AID PROCEDURES
Eye contact: Immediately flush with plenty of water, obtain medical care

Skin contact: Wash with soap and water

Inhalation: Provide fresh air, discard contaminated clothing

SECTION VI — REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	

INCOMPATABILITY (Materials to avoid)

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	XX	

SECTION VII — SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Spills can be absorbed in absorbent earth, the absorbent can be swept up and transferred to an open drum filled with water and allowed to stand in a ventilated location for 48 hours

WASTE DISPOSAL METHOD
Decontaminated waste is harmless and should be disposed according to local regulations

SECTION VIII — SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify Type)

VENTILATION	LOCAL EXHAUST	XX	SPECIAL
	MECHANICAL (General)		OTHER

PROTECTIVE GLOVES XX	EYE PROTECTION XX

OTHER PROTECTIVE EQUIPMENT
Boiler suit/overall

SECTION IX — SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE
Keep from water and moisture, use only with adequate ventilation, avoid eye contact, avoid prolonged breathing of vapor and prolonged or repeated skin contact.

OTHER PRECAUTIONS
Keep container closed when not in use.

FORM OSHA-20
Rev. May 72

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME: DE NEEF AMERICA INC.	EMERGENCY TELEPHONE NUMBER: (517) 681-5791
ADDRESS (Number, Street, City, State and Zip Code): 122 North Mill Street - St. Louis, Michigan 48880	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS: TACSS Accelerator: C-852/C-855
CHEMICAL FAMILY	FORMULA

SECTION II — HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES AND SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Alifatic Amine	100	

SECTION III — PHYSICAL DATA

BOILING POINT (°F) 3 mm, Hg	100° C	SPECIFIC GRAVITY (H_2O = 1)	0,90-0,95
VAPOR PRESSURE (mm Hg.) 25° C	<1	PERCENT, VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR = 1)		EVAPORATION RATE (BuOAc = 1)	<1
SOLUBILITY IN WATER	emulsion		
APPEARANCE AND ODOR Colorless or blue liquid, amine odor			

SECTION IV — FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) C.O.C. 108° C	FLAMMABLE LIMITS	LEL	UEL
EXTINGUISHING MEDIA Dry Chemical - CO2 - Water fog			
SPECIAL FIRE FIGHTING PROCEDURES Do not use foam			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

(Continued on reverse side)

SECTION V — HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Not established

EFFECTS OF OVEREXPOSURE
Liquids: Irritating to skin and eyes

Vapors: Irritating to eyes

EMERGENCY AND FIRST AID PROCEDURES
Eye contact: Immediately flush eyes with plenty of water. Obtain medical care

Skin contact: Wash with soap and water

Inhalation: Provide fresh air

SECTION VI — REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	XX	

INCOMPATABILITY (Materials to avoid): NONE

HAZARDOUS DECOMPOSITION PRODUCTS: NONE

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	XX	

SECTION VII — SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Collect as much as possible - wash down area with water as required

WASTE DISPOSAL METHOD
Incinerate properly, and maybe bleed slowly into waste water system with treatment plant (in accordance with local regulations)

SECTION VIII — SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify Type)

VENTILATION			
	LOCAL EXHAUST	XX	SPECIAL
	MECHANICAL (General)		OTHER

PROTECTIVE GLOVES		EYE PROTECTION	
	XX		XX

OTHER PROTECTIVE EQUIPMENT
Boiler suit/overall

SECTION IX — SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE
Use only with adequate ventilation, avoid eye contact or polonged breathing of vapor and prolonged or repeated skin contact. Keep container closed when not in use.

OTHER PRECAUTIONS

FORM OSHA-20
Rev. May '72

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Bert Kriekemans
General Manager
De Neef America Incorporated
122 North Mill Street
St. Louis, Michigan 48880-0034

RE: File Number 07-002.00AE883

This document should be retained as DWAAN 1579.

Dear Mr. Kriekemans:

Based on information submitted, the product listed below is acceptable for use as a coating for potable water applications when used within the conditions stated below:

Product: TACSS Chemical Grout

Conditions:

1. The product is properly applied according to the manufacturer's specifications.
2. The percentage of total surface covered is less than 10% of the area contacting the water.
3. The product continues to meet the specifications of good manufacturing practices.
4. After complete curing, the repaired surface is thoroughly rinsed with potable water prior to being placed in service.

We would not anticipate any adverse health effects resulting from such use of this product assuming the product continues to meet the supplied specifications.

We are currently in the process of revising our evaluation procedures as outlined in the Federal Register, Vol. 44, No. 141, 42775-8, July 20, 1979. When these revisions are completed and the interim procedures are in place, all existing advisories will be periodically reviewed.

Our opinion concerning the safety of the product does not constitute an endorsement, nor does it relate to its effectiveness for the intended use. If this letter is to be used in any way, we require that it be quoted in its entirety.

Sincerely yours,

Hugh F. Hanson, P.E., Chief
Science and Technology Branch
Criteria and Standards Division
Office of Drinking Water (WH-550)

cc: Regional Drinking Water Representatives
Holders of the Water Supply Guidance Series
Mr. John Trax, State Programs Division, ODW

A59

00-65
1086

3M General Offices
3M Center
St. Paul, Minnesota 55144-1000
612/733-1110
Duns No.: 00-617-3082

MATERIAL SAFETY
DATA SHEET

3M

DIVISION: CONSTRUCTION MARKETS
TRADE NAME:
SCOTCH-SEAL(TM) BRAND CHEMICAL GROUT 5600 (FOAM)
3M I.D. NUMBER: 62-5600-3520-6 62-5600-8521-9 98-0701-2987-3 98-0701-3968-2

ISSUED: JANUARY 3, 1992
SUPERSEDES: MAY 24, 1991
DOCUMENT: 10-4974-1

1. INGREDIENT

INGREDIENT	C.A.S. NO.			PERCENT
URETHANE PREPOLYMER	53426-99-6	80.0	-	90.0
ACETONE	67-64-1	10.0	-	20.0
TOLUENE 2,4-DIISOCYANATE	584-84-9	0.5	-	1.5
TOLUENE 2,6-DIISOCYANATE	91-08-7		<	0.4

THIS PRODUCT CONTAINS THE FOLLOWING TOXIC CHEMICAL OR CHEMICALS SUBJECT TO THE REPORTI
REQUIREMENTS OF SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATIC
ACT OF 1986 AND 40 CFR PART 372:
ACETONE
TOLUENE 2,4-DIISOCYANATE
TOLUENE 2,6-DIISOCYANATE

2. PHYSICAL DATA

BOILING POINT:	ca. 134.00 F
VAPOR PRESSURE:	ca. 180.0000 mmHg
VAPOR DENSITY:	ca. 2.00 Air = 1
EVAPORATION RATE:	ca. 1.90 Butyl Acetate = 1
SOLUBILITY IN WATER:	slight
SP. GRAVITY:	ca. 1.100 Water = 1
PERCENT VOLATILE:	ca. 15.00 % by wt
VOLATILE ORGANICS:	< 198.00 gms/liter
VOC LESS H2O & EXEMPT SOLVENT	< 198.00 gms/liter
pH:	N/A
VISCOSITY:	ca. 500.0 CPS
MELTING POINT:	N/D
APPEARANCE AND ODOR:	liquid, amber, sharp acetone odor

3. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:	25.00 F
FLAMMABLE LIMITS - LEL:	ca. 2.60 %
FLAMMABLE LIMITS - UEL:	ca. 12.80 %
AUTOIGNITION TEMPERATURE:	ca. 869.00 F

EXTINGUISHING MEDIA:
CO2, foam, dry chemical or water.
SPECIAL FIRE FIGHTING PROCEDURES:
Fire fighters should be equipped with full protective clothing and full face shield self-contained breathing apparatus.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
Extremely flammable. Overheated, closed containers adjacent to fire could explode due to pressure buildup.
NFPA-HAZARD-CODES: HEALTH 3 FIRE 3 REACTIVITY 1
UNUSUAL REACTION HAZARD: none

Abbreviations: N/D - Not Determined N/A - Not Applicable

A60

3M General Offices
3M Center
St. Paul, Minnesota 55144-1000
612/733-1110
Duns No.: 00-617-3082

00-65
1087

MATERIAL SAFETY
DATA SHEET

3M

4. REACTIVITY DATA

STABILITY: Stable
INCOMPATIBILITY - MATERIALS TO AVOID:
Reacts with moisture. Therefore, water and moisture must be avoided prior to use.
HAZARDOUS POLYMERIZATION: Will Not Occur
HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon monoxide, carbon dioxide and nitrogen decomposition products including the possibility of hydrogen cyanide.

5. ENVIRONMENTAL INFORMATION

SPILL RESPONSE:
Observe precautionary information in all sections. Prevent material from entering drains; use diking or cover floor drains if necessary. If material enters drain, flush with large amounts of water. Cover spill with an absorbent material. Collect in openhead drum or pail, stir in an estimated equal amount of water and let sit 1/2-hour.

RECOMMENDED DISPOSAL:
If waste is fully cured (by mixing with sufficient water), the gel could be buried in a sanitary landfill. Uncured liquid waste should be disposed of by chemical incineration or at a disposal facility capable of handling flammable wastes. Wastes should be disposed in accordance with local and state regulations. Uncured liquid waste material is designed as D001 (flammable waste) by USEPA RCRA Standards (40CFR Part 261.21).

ENVIRONMENTAL DATA:
N/D

SARA HAZARD CLASS:
FIRE HAZARD: Yes **PRESSURE:** No **REACTIVITY:** No **ACUTE:** Yes **CHRONIC:** Yes

6. SUGGESTED FIRST AID

EYE CONTACT:
Immediately flush eyes with plenty of water. Continue for 10 minutes holding eyelids open. Call a physician.

SKIN CONTACT:
Wash affected area with soap and water.

INHALATION:
If symptoms occur, remove person to fresh air. If symptoms continue, call a physician.

IF SWALLOWED:
Do not induce vomiting. If person is conscious give one to two glasses of water. Immediately call a physician.

Abbreviations: N/D - Not Determined N/A - Not Applicable

3M General Offices
3M Center
St. Paul, Minnesota 55144-1000
612/733-1110
Duns No.: 00-617-3082

00-65
1087

MATERIAL SAFETY
DATA SHEET

3M

4. REACTIVITY DATA

STABILITY: Stable
INCOMPATIBILITY - MATERIALS TO AVOID:
Reacts with moisture. Therefore, water and moisture must be avoided prior to use.
HAZARDOUS POLYMERIZATION: Will Not Occur
HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon monoxide, carbon dioxide and nitrogen decomposition products including the possibility of hydrogen cyanide.

5. ENVIRONMENTAL INFORMATION

SPILL RESPONSE:
Observe precautionary information in all sections. Prevent material from entering drains; use diking or cover floor drains if necessary. If material enters drain, flush with large amounts of water. Cover spill with an absorbent material. Collect in openhead drum or pail, stir in an estimated equal amount of water and let sit 1/2-hour.

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ENVIRONMENTAL DATA:
N/D

SARA HAZARD CLASS:
FIRE HAZARD: Yes **PRESSURE:** No **REACTIVITY:** No **ACUTE:** Yes **CHRONIC:** Yes

6. SUGGESTED FIRST AID

EYE CONTACT:
Immediately flush eyes with plenty of water. Continue for 10 minutes holding eyelids open. Call a physician.

SKIN CONTACT:
Wash affected area with soap and water.

INHALATION:
If symptoms occur, remove person to fresh air. If symptoms continue, call a physician.

IF SWALLOWED:
Do not induce vomiting. If person is conscious give one to two glasses of water. Immediately call a physician.

Abbreviations: N/D - Not Determined N/A - Not Applicable

3M General Offices
3M Center
St. Paul, Minnesota 55144-1000
612/733-1110
Duns No.: 00-617-3082

00-65
1088

MATERIAL SAFETY
DATA SHEET

3M

7. PRECAUTIONARY INFORMATION

OTHER PRECAUTIONARY INFORMATION:
Keep away from all sources of ignition. Avoid contact with eyes, skin, and clothing. Wear safety glasses or chemical goggles, butyl rubber gloves and long sleeved clothing. Launder contaminated clothing before reuse. Wash thoroughly after handling. Avoid breathing vapor . Provide ventilation sufficient to maintain vapor concentrations below recommended exposure limits. Keep container tightly closed when not in use. Store in a cool, dry area away from combustible materials and alcohols. Keep out of the reach of children. For professional use only.

EXPOSURE LIMITS

INGREDIENTS	VALUE	UNIT	TYPE	AUTH	SKIN*
URETHANE PREPOLYMER	NONE	NONE	NONE	NONE	
ACETONE	750	ppm	TWA	ACGIH	
ACETONE	1780	mg/m3	TWA	ACGIH	
ACETONE	1000	ppm	STEL	ACGIH	
ACETONE	2380	mg/m3	STEL	ACGIH	
ACETONE	750	ppm	TWA	OSHA	
ACETONE	1800	mg/m3	TWA	OSHA	
ACETONE	1000	ppm	STEL	OSHA	
ACETONE	2400	mg/m3	STEL	OSHA	
TOLUENE 2,4-DIISOCYANATE	0.005	ppm	TWA	ACGIH	
TOLUENE 2,4-DIISOCYANATE	0.036	mg/m3	TWA	ACGIH	
TOLUENE 2,4-DIISOCYANATE	0.02	ppm	STEL	ACGIH	
TOLUENE 2,4-DIISOCYANATE	0.14	mg/m3	STEL	ACGIH	
TOLUENE 2,4-DIISOCYANATE	0.005	ppm	TWA	OSHA	
TOLUENE 2,4-DIISOCYANATE	0.04	mg/m3	TWA	OSHA	
TOLUENE 2,4-DIISOCYANATE	0.02	ppm	STEL	OSHA	
TOLUENE 2,4-DIISOCYANATE	0.15	mg/m3	STEL	OSHA	
TOLUENE 2,6-DIISOCYANATE	0.005	ppm	TWA	3M	
TOLUENE 2,6-DIISOCYANATE	0.02	ppm	STEL	3M	

* **SKIN NOTATION:** Listed substances indicated with "Y" under SKIN refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

SOURCE OF EXPOSURE LIMIT DATA:
- ACGIH: American Conference of Governmental Industrial Hygienists
- OSHA: Occupational Safety and Health Administration
- 3M: 3M Medical Department Guideline
- NONE: None Established

8. HEALTH HAZARD DATA

EYE CONTACT:
Causes severe eye irritation.

SKIN CONTACT:
May cause skin irritation and allergic reaction.

Abbreviations: N/D - Not Determined N/A - Not Applicable

3M General Offices
3M Center
St. Paul, Minnesota 55144-1000
612/733-1110
Duns No.: 00-617-3082

00-65
1089

MATERIAL SAFETY
DATA SHEET

3M

8. HEALTH HAZARD DATA (continued)

INHALATION:
Vapor overexsposure may cause respiratory irritation, central nervous system depression, and allergic reaction. Symptoms may include dizziness, headache, nausea, shortness of breath, and tightness in the chest.

IF SWALLOWED:
Practically non-toxic based on laboratory animal studies.

OTHER HEALTH HAZARD INFORMATION:
CARCINOGENICITY: Toluene Diisocyanate is a potential cancer hazard causing subcutaneous, pancreatic, liver, mammary, and circulatory tumors by the oral route of exposure in laboratory animal studies (NTP, IARC-2B).

SECTION CHANGE DATES

HEADING	SECTION CHANGED SINCE MAY 24, 1991 ISSUE

Abbreviations: N/D - Not Determined N/A - Not Applicable

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 19 1983

Ms. Georjean L. Adams,
Sr. Regulatory Specialist
Environmental Laboratory,
Building 21-2W-05
Environmental Engineering &
Pollution Control/3M
P.O. Box 33331
St. Paul, Minnesota 55133

THIS DOCUMENT SHOULD BE RETAINED AS DWAAN #1457.

RE: File Number 6-14AEB83

Dear Ms. Adams:

Based on information submitted, the product listed below is acceptable as a grout for repair of leaking joints and cracks in potable water applications when used within the conditions stated below:

Product: Scotch-Seal Brand Chemical Grout 5600 (foam)

Conditions:

1. The product is properly applied according to the manufacturer's specifications.
2. The product continues to meet the specifications of good manufacturing practices.
3. After complete curing, the surface is thoroughly rinsed with potable water prior to being placed in service.

We would not anticipate any adverse health effects resulting from such use of this product assuming the product continues to meet the supplied specifications.

We are currently in the process of revising our evaluation procedures as outlined in the Federal Register, Vol. 44, No. 141, 42775-8, Friday, July 20, 1979. When these revisions are completed and the interim procedures are in place, all existing advisories will be periodically reviewed.

Our opinion concerning the safety of the product does not constitute an endorsement, nor does it relate to its effectiveness for the intended use. If this letter is to be used in any way, we require that it be quoted in its entirety.

Sincerely yours,

Hugh F. Hanson, P.E., Acting Chief
Additives Evaluation Branch
Criteria and Standards Division, ODW (WH-550)

cc: Regional Drinking Water Representatives
Holders of the Water Supply Guidance Series
Mr. John Trax, State Programs Division, ODW

98-0701-1747-2(26.2566)R2

MATERIAL SAFETY DATA SHEET
FLUORETRACT II LIQUID CONCENTRATE
PAGE 1 OF 4

MSDS PREPARATION INFORMATION

PREPARED BY: M. L. MOORMAN
(513) 773-8933
DATE PREPARED: 11/15/90

PRODUCT INFORMATION

MANUFACTURED BY: FORMULABS, INC.
1710 COMMERCE DRIVE
PIQUA, OHIO 45356
(513) 773-8933 BUSINESS
(800) 424-9300 CHEMTREC 24-HR EMERGENCY CONTACT

CHEMICAL NAME . . . . . NOT APPLICABLE
CHEMICAL FORMULA . . . . . NOT APPLICABLE
CHEMICAL FAMILY . . . . . AQUEOUS DYE

HAZARDOUS INGREDIENTS

HAZARDOUS INGREDIENT	%	T.L.V.	C.A.S. #
NONE PER 29 CFR 1910.1200			

PHYSICAL DATA

PHYSICAL STATE . . . . . LIQUID
ODOR AND APPEARANCE . . . . . BRIGHT YELLOW-GREEN, ODORLESS LIQUID
SPECIFIC GRAVITY . . . . . APPROXIMATELY 1.0
VAPOR PRESSURE (mm Hg @ 25 deg. C) . . . 23.75
VAPOR DENSITY (AIR = 1) 0.6
EVAPORATION RATE (Butyl Acetate = 1) . . 1.8
BOILING POINT . . . . . 100 deg C (212 deg F)
FREEZING POINT . . . . . 0 deg C (32 deg F)
pH . . . . . NOT APPLICABLE
SOLUBILITY IN WATER . . . . . INFINITE SOLUBILITY

FIRE OR EXPLOSION HAZARD

CONDITION OF FLAMMABILITY . . . . THIS PRODUCT IS NOT FLAMMABLE
MEANS OF EXTINCTION . . . . . WATERFOG, CARBON DIOXIDE, DRY CHEMICAL
FLASH POINT AND METHOD . . . . . NOT APPLICABLE

UPPER FLAMMABLE LIMIT	NOT APPLICABLE
LOWER FLAMMABLE LIMIT	NOT APPLICABLE
AUTO-IGNITION TEMPERATURE	NOT APPLICABLE
HAZARDOUS COMBUSTION PRODUCTS	NOT APPLICABLE
UNUSUAL FIRE HAZARD	NOT APPLICABLE
EXPLOSION DATA	
SENSITIVITY TO STATIC DISCHARGE	NOT APPLICABLE
SENSITIVITY TO MECHANICAL IMPACT	NOT APPLICABLE

REACTIVITY DATA

PRODUCT STABILITY	STABLE
PRODUCT INCOMPATIBILITY	NONE KNOWN
CONDITIONS OF REACTIVITY	NOT APPLICABLE
HAZARDOUS DECOMPOSITION PRODUCTS	BURNING WILL PRODUCE OXIDES OF CARBON, NITROGEN, AND/OR SULFUR.

TOXICOLOGICAL PROPERTIES

SYMPTOMS OF OVEREXPOSURE FOR EACH POTENTIAL ROUTE OF ENTRY:	
INHALATION, ACUTE	NO HARMFUL EFFECTS EXPECTED.
INHALATION, CHRONIC	NO HARMFUL EFFECTS EXPECTED.
SKIN CONTACT	WILL TEMPORARILY COLOR THE SKIN.
SKIN ABSORPTION	NO HARMFUL EFFECTS EXPECTED.
EYE CONTACT	MAY CAUSE IRRITATION AND BURNING.
INGESTION	MAY CAUSE NAUSEA. INGESTION MAY RESULT IN A YELLOW-GREEN COLOR TO THE URINE UNTIL ALL DYE HAS BEEN FLUSHED FROM THE SYSTEM.
EFFECTS OF ACUTE EXPOSURE	NO HARMFUL EFFECTS EXPECTED.
EFFECTS OF CHRONIC EXPOSURE	NO HARMFUL EFFECTS EXPECTED.
THRESHOLD LIMIT VALUE	NOT APPLICABLE.
CARCINOGENICITY	NOT LISTED BY ANY REGULATORY AGENCY AS A KNOWN OR SUSPECTED HUMAN CARCINOGEN.
TERATOGENICITY	NONE KNOWN
MUTAGENICITY	NONE KNOWN
TOXICOLOGICALLY SYNERGISTIC PRODUCTS	NONE KNOWN

PREVENTIVE MEASURES

PERSONAL PROTECTIVE EQUIPMENT:	
GLOVES	RUBBER GLOVES

RESPIRATORY	USE DUST MASK IF NECESSARY
CLOTHING	PROTECTIVE CLOTHING WHERE SKIN CONTACT IS UNAVOIDABLE.
OTHER	HAVE ACCESS TO AN EYEWASH.
ENGINEERING CONTROLS	NOT NECESSARY UNDER NORMAL OPERATING CONDITIONS.
SPILL OR LEAK RESPONSE	SOAK UP SMALL SPILLS WITH PAPER. SOAK UP LARGE SPILLS WITH EARTH, SAWDUST, OR OTHER SUITABLE ABSORBENT. WASH SPILL SITE WITH WATER.
WASTE DISPOSAL	DISPOSE OF WASTE IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS.
HANDLING PROCEDURES AND EQUIPMENT	NO SPECIAL REQUIREMENTS.
STORAGE REQUIREMENTS	STORE AT ROOM TEMPERATURE BUT ABOVE THE FREEZING POINT OF WATER.
SHIPPING INFORMATION	KEEP FROM FREEZING.

FIRST AID MEASURES

FIRST AID EMERGENCY PROCEDURES:

EYE CONTACT	FLUSH WITH WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION.
SKIN CONTACT	WASH WITH SOAP AND WATER.
INHALATION	IF BREATHING BECOMES DIFFICULT, GET MEDICAL ATTENTION.
INGESTION	IF SWALLOWED, GIVE SEVERAL GLASSES OF MILK OR WATER AND INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION. NEVER GIVE FLUIDS OR INDUCE VOMITING IF PATIENT IS UNCONSCIOUS OR HAS CONVULSIONS.

SPECIAL NOTICE

All information, recommendations, and suggestions appearing herein concerning this product are based upon data obtained from the manufacturer and/or recognized technical sources; however, Formulabs, Incorporated makes no warranty, representation or guarantee as to the accuracy, sufficiency or completeness of the material set forth herein. It is the user's responsibility to determine the safety, toxicity and suitability of his own use, handling, and disposal of the product. Additional product literature may be available upon request. Since actual use by others is beyond our control, no warranty, express or implied, is made by Formulabs, Incorporated as to the effects of such use, the results to be obtained or the safety and toxicity of the

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product, nor does Formulabs, Incorporated assume any liability arising out of use by others of the product referred to herein. The data in the MSDS relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

END OF MATERIAL SAFETY DATA SHEET

Appendix B
Compendium of State Grout Requirements

QUARTERLY PROGRESS REPORT

to the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

on Project

TRB 21-4

Sealing Geotechnical Exploratory Holes to Protect the Subsurface Envir

for period

July 1, 1991 to September 30, 1991

from

STRATA ENGINEERING CORP.

QUARTERLY PROGRESS REPORT - TRB 21-4, September 30, 1991

Sealing Geotechnical Exploratory Holes to Protect the Subsurface Environment

1.0 INTRODUCTION

This constitutes the Second Quarterly Progress Report on TRB Project 21-4. It contains a description of resear accomplishments to date and provides an overview of planned research into the third quarter, October 1 to December 3 1991.

1.1 Research Problem Statement

Geotechnical exploratory holes often penetrate water bearing formations. There is concern that these holes can becon conduits for contamination, commingling or loss of groundwater. To protect the subsurface environment, geotechnic organizations are being asked by water-resource agencies to use water-well drilling techniques and regulations that are nc necessarily applicable to routine geotechnical practices. Moreover use of water-well drilling methods and machinery fo geotechnical exploration results in considerably higher costs to geotechnical organizations (including highway agencies) t modify procedures and obtain new equipment. Research is needed to develop suitable seals, which will adequately protec the subsurface environment, for closure and for installation of instruments in small diameter geotechnical exploratory holes.

1.2 Scope of Problem

Such exploratory holes, whether bored or created by displacement techniques, constitute a potential conduit for contamination of the subsurface environment if they are not properly sealed. They can also lead to loss of groundwater, such as uncontrolled artesian flow. It is therefore important to return the subsurface environment to its pre-exploration drilling condition by providing cost effective and verifiable seals in important zones of the subsurface stratigraphic column.

Current methods of sealing water well holes and abandoned wells are not appropriate for geotechnical exploratory holes due to differences in size and depth of the holes, original purpose of the holes and their intended functions, time constraints, and costs. Hence, specific solutions must be found for sealing geotechnical exploratory holes made for transportation related activities.

Often, geotechnical exploratory holes are instrumented for short or long term observations of settlements, pore pressures, and lateral movements. The space available within such holes for effective sealing against contaminant migration or commingling is much less than that for un-instrumented holes. This fact, combined with the variety of materials used in instrumented holes (from PVC to steel, cables, wires, etc.) leads to complex conditions for which traditional sealing methods may not be suitable for adequate protection of the environment.

The increasing deployment of in situ soil testing techniques such as piezocones, cone penetrometers and dilatometers requires that attention be also paid to these small diameter displacement type holes, which traditionally have not been deliberately backfilled or sealed against contamination. Hence, the sealing methods to be developed must address both conventional geotechnical boreholes and small diameter in situ testing holes.

2.0 OBJECTIVES OF RESEARCH

2.1 Goals

The broad objectives of this research are to develop (1) technical guidelines for materials and methods for placing seals in instrumented holes and for decommissioning small-diameter geotechnical exploratory holes in order to protect groundwater from contamination and loss, and (2) methods for verification of these seals.

The focus of this research is therefore to determine viable, economical, effective and verifiable seals and sealing methods to protect the subsurface environment from geotechnical exploratory holes made by common drilling and in situ testing methods.

2.2 Specific Objectives

The specific objectives of this research are:

(1) to test, in the laboratory and in the field, sealing materials and methods for use in instrumented and un-instrumented holes compatible with pre-exploratory subsurface conditions and for normal drilling and in situ testing practices;

(2) to recommend procedures for effective and economical decommissioning of geotechnical exploratory holes in order to protect the subsurface environment and to control water loss;

(3) to develop practical guidelines for material selection and methods to place effective seals in instrumented and un-instrumented geotechnical exploratory holes;

(4) to develop and test procedures for seal verification.

2.3 Tasks

The following tasks are included in the research:

Task 1. Summarize the state of the practice in small diameter geotechnical exploratory holes. The summary shall include a list of viable seals using readily obtainable materials for both instrumented and un-instrumented holes.

Task 2. Using the list developed in Task 1, develop and perform a testing program for the viable seals. The type and extent of testing of the sealing systems should be sufficient to evaluate: (a) the effectiveness and limitations of each sealing material; (b) the long term performance of each seal; (c) the performance of each seal when subjected to naturally occurring salts, minerals, acids and the like; (d) the influence of seal thickness (vertical dimension); (e) the ability to satisfactorily seal small annular spaces in instrumented holes; (f) the constructability of each seal type, above and below groundwater, in artesian conditions, and at various depths below the ground surface to a maximum depth of about 200 feet (60m); and (g) the influence of various geological conditions on the performance of each seal type.

Task 3. Develop procedures to verify that the seal in situ will perform as intended.

Task 4. Develop comprehensive guidelines for sealing geotechnical exploratory holes. This would include seal design procedures, schematics showing each seal design, specifications for each seal material, suitable placement techniques, and verification procedures.

Task 5. Prepare a final report describing the research performed and presenting the comprehensive guidelines. Sufficient research results must be included in the report to conclusively justify the recommended guidelines.

3.0 WORK PLAN

The research is being conducted in eight phases, as summarized below. Details of the work to be performed in each phase have been submitted earlier with the Work Plan for the project.

Phase 1 - Review of Current State of Practice and Policies

Phase 1 is intended to gather information on current policies and practices from a number of public and private jurisdictions and agencies/departments involved in geotechnical exploration activity. This information will form a basis for the specific design of seal testing programs both in the laboratory and in the field. Attention will be paid to reported problems with current practices.

Phase 2 - Detailed Literature Review

This phase will be conducted simultaneously with Phase 1. A review of current literature on the subject of hole sealing will include practices from the oil and water well drilling industries, from current thinking on sealing nuclear waste vaults and chambers and from work underway in providing leachate barriers at landfill sites.

Phase 3 - Laboratory Testing
Phase 3 comprises laboratory testing of various sealing materials and investigation of potential methods to achieve effe seals under a variety of controlled laboratory conditions to determine their viability for field applications. This worl be done in two stages. Stage 1 will consist of fabrication of the testing apparatus and trial testing to ensure its operati validity. Stage 2 will consist of tests to simulate field sealing applications, using a variety of sealing materials and meth

Phase 4 - Field Installations
In this phase, the three field sites at Amherst, Iowa and Ottawa (Canada) will become operational for drilling, sampl sounding and placement of seals.

Phase 5 - Field Seal Testing
Field testing programs will be initiated to place seals in selected holes and soil types (drilled, displacement, augu instrumented, un-instrumented). Costs associated with seal installation will be monitored (supplies, drill rentals, manpov &c.).

Phase 6 - Seal Verification
In this phase, field tests will be conducted on the installations of Phase 5 to verify the seals are operating as intended. T pits will be placed adjacent to the holes at one of the three sites (to be determined upon completion of Phase 3).

Phase 7 - Development of Comprehensive Hole Sealing Guidelines
In this phase, feasible and practical guidelines will be developed for use by drilling contractors and agencies involved geotechnical exploratory activities.

Phase 8 - Final Report
Draft and Final reports of the research will be prepared and submitted.

SECOND QUARTER PROGRESS - SUMMARY

Progress made during the second quarter (July 1 to September 30, 1991) is reported in summary form in this sectior Details are found in the cited Appendices following the Tables and Figures.

4.0 PHASE 1 - REVIEW OF CURRENT STATE OF PRACTICE AND POLICIES

4.1 Introduction
Phase 1 of the project is intended to gather existing information on current regulatory policies and practices regarding the sealing of exploratory holes. In order to provide a broad view of the problem, solicitations were made to a number of public and private jurisdictions and agencies or departments involved in geotechnical and other soil exploration activities. This information will be used in part to form a basis for the specific design of prototype seal testing programs both in the laboratory and in the field and will also provide essential background on the current (1991) state-of-the-practice.

4.2 Objectives
The objectives of the borehole sealing practice survey are to:

1. Obtain a reasonably accurate indication of the current state-of-the-practice of sealing exploratory holes,
2. Determine the current status of regulations regarding sealing of exploratory holes, and
3. Determine if any innovative sealing or performance monitoring techniques are being used in practice.

4.3 Approach
Two approaches were implemented to obtain information on current practices. The first approach consisted of a letter campaign requesting current regulations, recommendations, and/or guidelines for sealing/backfilling geotechnical exploratory holes. Because regulations may depend on local or regional variations in geology, groundwater conditions and drilling procedures, requests were made to each state within the United States and each province in Canada. In the U.S. letters were sent to:

52 State Departments of Transportation,
29 State Geological Surveys,
32 State Departments of Natural Resources, and
24 State Departments of Environmental Quality/Protection.

Since there is some overlap of agencies within each state, every state did not receive four enquiries.

The second approach consisted of a general mailing of a Borehole Sealing Practice Questionnaire requesting information on current procedures used by individual practitioners for sealing/backfilling geotechnical exploratory holes. A detailed borehole sealing practice survey, shown in Appendix I, was prepared to solicit and collate information on existing practice. These questionnaires were sent to: (1) practising geotechnical engineers, obtained from the Association of Soil and Foundation Engineers (ASFE) Membership List and the Consulting Engineers Council Directory, and (2) environmental drilling consultants and contractors, obtained from a directory published in the Spring 1990 issue of Ground Water Monitoring Review.

4.4 Results

4.4.1 Current Regulations

The shaded states shown in Figures 1 to 4 are based on individual state organizations and indicate states in which responses to the request for current regulations were received. Responses were received from:

49 State Departments of Transportation,
16 State Geological Surveys,
13 State Departments of Natural Resources, and
13 State Departments of Environmental Quality/Protection.

Tables 1 to 4, which are also based on individual state organizations, present typical sealant mixtures that the states employ. The most common sealant mixtures used by all organizations are:

1. Bentonite,
2. Cement,
3. Cement-Bentonite,
4. Cement-Sand, and
5. Concrete.

A typical bentonite mixture consists of 1-2 pounds of bentonite per gallon of water. The mixture shall be of sufficient viscosity to require a time of at least 60 seconds to discharge 1 quart of material through an American Petroleum Institute (API) marsh funnel viscometer.

A typical cement mixture is composed of 1 bag of portland cement per 5-6 gallons of water. The cement-bentonite mixtures have this same cement-water proportioning with 2-8%, by weight, or 2-8 pounds of bentonite added.

A typical cement-sand mixture is composed of 1 bag of portland cement per 5-6 gallons of water to which not more than 2 parts sand to 1 part cement may be added. The concrete mixture is in the same proportions as the cement-sand mixture but has gravel of crushed stone as a part of the sand additive.

Appendix II contains a detailed summary of each state's practices on an organizational basis.

Current regulations/guidelines enforced by state Departments of Transportation may be divided into three broad categories as follows:

1. No written regulations,
2. State requires that the Department of Transportation's regulations be followed, and
3. State requires that another state agency, besides the Department of Transportation, regulations be followed.

The shaded areas in Figures 5 to 7, which are based on these three categories, indicate the states that follow a parti category. Table 5 summarizes all of the state Departments of Transportation practices. Appendix III contains a det summary of each state's practices based on the three categories.

4.4.2 Current State-of-Practice

The shaded areas in Figure 8 indicate the states in which consultants have responded to the borehole sealing pra survey. Practice surveys were sent to 407 practising consultants in the U.S. A total of 49 replies were received f response success of 12%. Based on geographic region, responses were received from:

13 Northeast states,
6 Southeast states,
12 Midwest states,
2 Northwest states, and
16 Southwest states.

While the total number of response is low, the distribution should give a reasonable assessment of current practice. Ta 6 is a detailed question by question statistical breakdown of the responses received by the U.S. consultants. It is interest to note that 51% of the U.S. consultants are aware of existing guidelines or regulations pertaining to sealing geotechni exploratory holes and 63% have an "in-house" policy regarding the sealing of the holes. This information is encourag and suggests current trends in environmental awareness. Based on the responses from the surveys, the curre state-of-practice of sealing boreholes appear to be:

1. Seal the borehole with bentonite-cement,
2. Backfill the borehole with native soil cuttings,
3. Seal the borehole with bentonite, and
4. Seal the borehole with cement.

These practices are given in order of decreasing use. Appendix IV contains a detailed summary of the responses receiv by the U.S. consultants.

Surveys were sent to 295 various Canadian sources and 35 replies were received, for an average response of 13.6%. Tabl 7 and 8 are detailed question by question statistical breakdown of the responses received by the Canadian consultants ar contractors and also the Canadian government agencies. Table 9 is a further breakdown of responses by provinces ar category of respondents. It is interesting to note that only 8.3% of the Canadian consultants and contractors are awa of existing guidelines or regulations pertaining to sealing geotechnical holes as opposed to the 51% of U.S. consultant Also, only 33.3% have an "in-house" policy regarding the sealing of holes as opposed to the 63% of the U.S. consultant

5.0 PHASE 2 - DETAILED LITERATURE REVIEW

A detailed literature review, to obtain information on the hydraulic conductivity of selected borehole sealants, especiall bentonite, is in progress. A wide spectrum of literature topics are being reviewed such as:

- Influence of permeants upon the permeability of bentonite,
- Cement-bentonite slurries,
- Annular space material for wells,
- Decommissioning and abandonment of water wells,
- Pore pressure changes due to bentonite pellet seals, and
- Proprietary hole sealing products and processes.

Appendix V contains a list of references that have been obtained thus far.

Additionally, an extensive literature search has taken place and continues on laboratory methods to measure hydraulic conductivity. Particular interest is focused on apparatus and factors which affected the measured hydraulic conductivity of a soil in laboratory tests. Factors include the effects of permeant, gradient, microorganisms, type of permeameter, sample preparation, saturation and air entrapment.

Table 1. Typical State Departments of Transportation Sealant Mixtures.

Type	State	Mix
Bentonite	Indiana	Minimum of 1 1/2 lb of bentonite per gal of water. The polymer should be mixed at the manufacturer's suggested rate, usually 1 qt per 100 gal of water. The polymer should be mixed with the water before introduction of the bentonite. No more than 100 gal of water should be prepared at one time. (Polymer = anionic liquid emulsion)
	Kansas	Mixture that shall be as per manufacturer's recommendations to achieve a weight of not less than 9.4 lb per gal of mix.
	Mississippi	100 lb of "Polygel" bentonite per 200 gal of water.
	Montana	For flowing wells: Shall be of sufficient viscosity to require a time of at least 70 sec to discharge 1 qt of material through an API marsh funnel viscometer. Shall weigh not less than 9 lb/gal. It must be fresh bentonite with no additives or polymers. For monitoring wells: Mixture of at least 1.5 lb of bentonite clay per gal of water.
	Nebraska	Viscosity must exceed 60 sec/qt (Marsh Funnel).
	New Jersey	Weighing at least 14 lb per gal cement grout or neat cement.
	Wisconsin	Mud weight is a minimum of 11 lb per gal.
Cement	Florida	1 sack of portland cement to 5 1/2 gal of water.
	Indiana	Mixture of 94 lb of portland cement of no more than 6 gal of water. If additives are used they shall not exceed 5% by weight of the mixture.
	Kansas	Mixture of 94 lb of portland cement to 5 to 6 gal of water.
	Michigan	Thick slurry of portland cement and water to which may be added calcium chloride. The ratio of 5 to 6 gal of water to a 94 lb sack of cement produces a suitable grout.
	Nebraska	Viscosity must exceed 60 sec/qt (Marsh Funnel).
	Nevada	Mixture of water and cement in a ratio of not more than 5 to 6 gal of water per bag of portland cement (1 yd^3 or 94 lb).
	Wisconsin	94 lb bag of cement to 5 gal of water.
Cement-Bentonite	California	30%/70% bentonite-cement mix: 1 gal water/1.25 lb bentonite/2.92 lb cement
	Illinois	Neat cement containing bentonite, aquajel or similar materials from 2% to 6% by weight.
	Louisiana	No more than 8% bentonite by dry weight of the cement and a maximum of 10 gal of water per sack (94 lb) of cement.
	Mississippi	50 lb cement, 30 lb lime, 20 lb bentonite, and 40 gal water

	Montana	For flowing wells: Mixture of not more than 6 gal of water per 94 lb bag of portland cement. Up to 5%, by weight, of bentonite may be used. For monitoring wells: Mixture of not more than 6 gal of water per 94 lb sack of portland cement. Up to 5 lb of bentonite clay per sack of cement may be added. When bentonite is added, the quantity of water may be increased by 0.1 gal for each lb of bentonite per sack of cement.
	New York	2 ft^3 of cement and 1/3 ft^3 of powered bentonite added to 35 gal (4.67 ft^3) of water.
	South Carolina	94 lb of portland cement (Type I), 5 to 8 lb of powdered bentonite,8 1/2 gal of water.
	South Dakota	For borcholes: 1:1 to 2:1 by weight For instrumentation holes: 184 lb cement, 50 lb bentonite, 32 gal water
	Tennessee	80% portland cement/20% bentonite
	Texas	282 lb cement, 250 lb lime (hydrated), 60 lb Quickgel bentonite, and 216 gal water
Cement-Fly Ash	Montana	For monitoring wells: Mixture of not more than 6 gal of water per 94 lb bag of portland cement. Commercial fly ash may be substituted on a weight basis for up to 1/2 of the portland cement.
Cement-Fly Ash-Bentonite	Montana	For monitoring wells: Mixture of not more than 6 gal of water per 94 lb bag of portland cement. Up to 5 lb of bentonite clay per sack of cement may be added. When bentonite is added, the quantity of water may be increased 0.1 gal for each lb of bentonite per sack of cement. Commercial fly ash may be substituted on a weight basis for up to 1/2 of the portland cement
Cement-Sand	Arizona	Equal parts of cement and sand, mixed with no more than 6 gal of water per 94.6 lb sack of cement.
	Kansas	Mixture of 94 lb of portland cement to equal volumes of sand having a diameter no larger than 0.08 in. to 5 to 6 gal of water.
	Montana	For flowing wells: Mixture of not more than 2 parts sand to 1 part cement and not more than 6 gal of water per 94 lb bag of portland cement.
	Nevada	Mixture of portland cement, sand and water which contains at least 7 bags of cement per yd^3 and not more than 7 gal of clean water for each bag of cement (1 yd^3 or 94 lb).
	Pennsylvania	8 gal of water and 650 lb of fine aggregate per bag of cement. Fine aggregate must meet requirements of AASHTO M-6.

Cement-Sand-Bentonite	Montana	For flowing wells: Mixture of not more than 2 parts sand to 1 part cement and not more than 6 gal of water per 94 lb bag of portland cement. Up to 5%, by weight, of bentonite may be used.
	Tennessee	60% portland cement/20% sand/20% bentonite or 20% portland cement/60% sand/20% bentonite
Clay	Wisconsin	Mud weight is a minimum of 11 lb per gal.
Concrete	Montana	For monitoring wells: Mixture of sand, portland cement, water, and 4 to 8% air. May contain gravel. Shall contain at least 6 sacks of cement per yd^3 and have a 28 day compressive strength of at least 4000 psi.
	Nevada	Mixture of portland cement, sand, 1/4 in. minus aggregate and water which contains at least 5 bags of cement per yd^3 of concrete and not more than 7 gal of clean water per bag of cement (1 yd^3 or 94 lb).
Concrete-Fly Ash	Montana	For monitoring wells: Mixture of sand, portland cement, water, and 4 to 8% air. May contain gravel. Fly ash may be substituted for up to 25% of the portland cement. Shall contain at least 6 sacks of cement per yd^3 and have a 28 day compressive strength of at least 4000 psi.

Table 2. Typical State Geological Surveys Sealant Mixtures.

Type	State	Mix
Bentonite	Iowa	Mixture of 10% processed bentonite (by weight) and water. The mixture has a viscosity of 70 sec/qt.
	Missouri	Shall be of sufficient viscosity to require a time of at least 70 sec to discharge 1 qt of the material through API marsh funnel viscometer.
	Oregon	Mixed to a marsh funnel viscosity of 60 sec/qt or at least 20 sec/qt greater than that of the drilling mud, whichever viscosity is greater.
	Pennsylvania	Composed of not less than 2 lb of clay per gal of water.
Cement	Iowa	Mixture of 1 sack (94 lb) of portland cement to not more than 6 gal of water.
	Oregon	Cement used should be API Class A or B, or ASTM C-150 Type I or II neat cement with no additives, mixed in proportion of 5.2 gal of water per standard 94 lb sack and having a mud weight of 15.6 lb per gal.
	Pennsylvania	Composed of 1 bag of cement for 5 to 8 gal of water.
Cement-Bentonite	Iowa	Mixture of 1 sack (94 lb) of portland cement to not more than 6 gal of water. Bentonite up to 2% by weight may be added.
	Oregon	Cement used should be API Class A or B, or ASTM C-150 Type I or II neat cement with no additives. Up to 4% (by weight of cement) sodium bentonite gel powder with no additives may be added to the cement (3.75 lb per sack of cement). For each lb of bentonite added, up to an additional 0.7 gal of water area added to the original neat cement mix of 5.2 gal per sack, for a maximum water content of 7.8 gal per sack of cement with 4% bentonite. The water and bentonite should be mixed first, and the cement added to the bentonite slurry.
Cement-Sand	Iowa	Mixture of 1 sack (94 lb) of portland cement, an equal amount by volume of clean masonry sand, and not more than 6 gal of water.
	Pennsylvania	Composed of 1 bag of cement for 5 to 8 gal of water. 2 part to 1 part cement may be added.
Concrete	Iowa	Mixture of 1 sack (94 lb) of portland cement, an equal amount by volume of sand and gravel or crushed stone, and not more than 6 gal of water.
Drill Muds	Missouri	Shall be of sufficient viscosity to require a time of at least 70 sec to discharge 1 qt of the material through API marsh funnel viscometer.

Table 4. Typical State Departments of Environmental/Quality Protection Sealant Mixtures.

Type	State	Mix
Bentonite	Nebraska	Viscosity to exceed 60 sec/qt (marsh funnel).
	North Dakota	Approximately 8 gal of water to saturate one 50 lb bag of bentonite.
Cement	Minnesota	94 lb of portland cement (ASTM C150-69a) and not more than 6 gal of water.
	Nebraska	Viscosity to exceed 60 sec/qt (marsh funnel).
Cement-Bentonite	Minnesota	94 lb of portland cement (ASTM C150-69a) and not more than 6 gal of water. Bentonite up to 2% by weight of cement may be used.
Concrete	Minnesota	94 lb of portland cement (ASTM C150-69a), equal volume of dry sand and not more than 6 gal of water. Where large volumes are required to fill annular openings, gravel not larger than 1/2 in. size may be added.
	Nebraska	Viscosity to exceed 60 sec/qt (marsh funnel).
Drill Muds	Minnesota	Viscosity of at least 70 sec to discharge 1 qt of the material through an API Marsh funnel viscometer.
	Wyoming	10 min gel strength of at least 20 lb/100 ft^3. Filtrate volume not to exceed 13.5 cm^3.

Table 5. Summary of State Departments of Transportation Practices.

State	DOT Practice	Comments	Mix
Alabama	Backfill with cuttings	No written regulations	
Alaska	Backfill with cuttings	No written regulations	
Arizona	Follow other state agencies regulations	Arizona Department of Water Resources regulations	Cement grout: Equal parts of cement and sand, mixed with no more than 6 gal of water per 94.6 lb sack of cement.
Arkansas	Follow DOT regulations		
California	Follow DOT regulations		
Colorado		No written regulations	
Connecticut	Do not seal abandoned boreholes after drilling	No written regulations	
District of Columbia	Follow DOT regulations		
Florida	Different areas of the state enforce the use of the Florida Department of Environmental Regulation rules.	No written regulations	Neat cement grout: 1 sack of portland cement to 5 1/2 gal of water.
Georgia	Follow DOT regulations		
Hawaii	Follow DOT regulations		
Idaho	Backfill with cuttings	No written regulations	
Illinois	No mandatory regulations but generally follow the sealing requirements established in the Illinois Water Well Construction Code.	No written regulations	Neat cement containing bentonite, aquajel, or similar materials from 2 to 6% by weight.
Indiana	Follow DOT regulations		Bentonite slurry: Minimum of 1 1/2 lb of bentonite per gal of water. The polymer should be mixed at the manufacturer's suggested rate, usually 1 qt per polymer should be mixed with water before introduction of the bentonite. No more than 100 gal of water should be prepared at one time. Neat cement: Mixture of 94 lb of portland cement to no more than 6 gal of water. If additives are used they shall not exceed 5% by weight of the mixture. Note: Bentonite - powdered or portland cement Polymer - anionic liquid emulsion
Iowa	Have no policy and are exempt by state law from backfilling	No written regulations	

Kansas	Follow other state agencies regulations	Kansas Department of Health and Environment regulations	Neat cement grout: Mixture of 94 lb of portland cement to 5 to 6 gal of water. Cement grout: Mixture of 94 lb of portland cement to equal volumes of sand having a diameter no larger than 0.08 in. to 5 to 6 gal of water. Bentonite clay grout: Mixture that shall be as per manufacturer's recommendations to achieve a weight of not less than 9.4 lb per gal of mix. Sodium bentonite pellets, tablets, or granular sodium bentonite may also be used provided they meet the specifications. Sodium bentonite products that contain low solids or that contain organic polymers shall not be used.
Kentucky	Backfill with cuttings	No written regulations	
Louisiana	Follow other state agencies regulations	Office of Public Works, Water Resources Section of the LA DOTD	Cement-bentonite slurry: No more than 8% bentonite by dry weight the cement and a maximum of 10 gal of water per sack (94 lb) of cement.
Maine	Normally backfill with cuttings. In some cases, particularly where artesian water pressure occurs, the holes are sealed using bentonite.	No written regulations	
Maryland	All borings that do not penetrate the watertable are backfilled with cuttings. Borings that penetrate the watertable are usually not sealed unless they are in an area that has contamination or is environmentally sensitive. Sealing consists of withdrawing or destroying any casing and backfilling with a slurry of bentonite and/or portland cement grout.	No written regulations	
Massachusetts	Follow DOT regulations		
Michigan	Follow DOT regulations		Cement grout: Will consist of a thick slurry of portland cement and water to which may be added sand and calcium chloride. The ratio of 5 to 6 gal of water to a 94 lb sack of cement produces a suitable grout.
Minnesota	Backfill with cuttings. Foundations crews grout all boreholes with concrete grout, bentonite grout, or neat cement grout.	No written regulations but the MN Department of Health is developing regulations.	

Mississippi	Follow other state agencies regulations	Office of Land and Water Resources, Department of Environmental Quality	Cement-bentonite grout: 50 lb of cement, 30 lb of lime, 20 lb of bentonite, and 40 gal of water. Bentonite slurry: 100 lb of "Polygel" bentonite per 200 gal of water.
Missouri	Backfill with cuttings except where an aquifer has been penetrated. In such cases, a thick bentonite slurry is used unless flowing water is present, in which, quick-setting cement is used.	No written regulations	

Nebraska	Follow other state agencies regulations	Nebraska Department of Health and Environmental Council for water well standards.	Cement, cement grout or bentonite grout with a viscosity to exceed 60 sec/qt (Marsh Funnel).
Nevada	Follow other state agencies regulations	Nevada State Department of Conservation and Natural Resources	Cement grout: Mixture of portland cement, sand and water which contains at least 7 bags of cement per yd^3 and not more than 7 gal of water for each bag of cement (1 yd^3 or 94 lb). Concrete grout: Mixture of portland cement, sand, 1/4 in. minus aggregate and water which contains at least 5 bags of cement per yd^3 of concrete and not more than 7 gal of clean water per bag of cement (1 yd^3 or 94 lb). Neat cement: Mixture of water and cement in a ratio of not more than 5 to 6 gal of water per bag of portland cement (1 yd^3 or 94 lb).
New Hampshire	Backfill with cuttings	No written regulations	
New Jersey	Follow other state agencies regulations	NJ Department of Environmental Protection, Division of Water Resources	Bentonite slurry weighing at least 14 lb per gal cement grout or neat cement.
New York	Backfill with cuttings. If encounter artesian pressure or groundwater contamination would result in a serious problem, seal with cement-bentonite grout.	No written regulations	2 ft^3 of cement and 1/3 ft^3 of powdered bentonite added to 35 gal (4.67 ft^3) of water.
North Carolina	Follow DOT regulations		
North Dakota	Follow DOT regulations		
Ohio	Backfill with cuttings	No written regulations	
Oklahoma	Follow DOT regulations		
Oregon	Practice ranges from no sealing to backfilling with native soil cuttings, bentonite, cement, bentonite/cement, or native soil cuttings mixed with bentonite	No written regulations	
Pennsylvania	Follow DOT regulations		Sand-cement grout: 8 gal of water and 650 lb of fine aggregate of cement. Fine aggregate must meet requirements of AASHTO M-6.
Puerto Rico	Backfill with cuttings	No written regulations	
South Carolina	Boreholes that must be sealed for environmental protection of an aquifer are sealed by grouting with a tremie from bottom to top, in one continuous operation, with a cement/bentonite grout.	No written regulations	Cement/bentonite grout: 94 lb of portland cement (Type I), 5 to 8 lb of powdered bentonite, and 8 1/2 gal of water.

South Dakota	Pressure grout all artesian flows from bottom to top with cement/bentonite grout.	No written regulations	Cement/bentonite grout: 184 lb of cement, 50 lb of bentonite, and 32 gal of water.
Tennessee	Backfill with cuttings	No written regulations	
Texas		No written regulations	Grout: 282 lb of cement, 250 lb of hydrated lime, 60 lb of Quickgel bentonite, and 216 gal of water.
Utah	Dry holes - backfill with cuttings Wet holes - pour bentonite chips or pellets to water surface. Fill remainder of the hole with cuttings. Artesian flows - pump bentonite grout to the surface	No written regulations	
Vermont	Backfill with cuttings. If near an individual drinking water supply, seal with bentonite grout.	No written regulations. Currently the Agency of Natural Resources, Environmental Protection Regulation is drafting regulations.	
Virginia	Backfill with cuttings. If potential for pollution, seal with bentonite.	No written regulations	
Washington	Follow other state agencies regulations	Washington State Department of Ecology	
West Virginia	Follow DOT regulations		
Wisconsin	Follow DOT regulations		Neat cement grout ratio: 94 lb bag of cement to 5 gal of water. Bentonite slurry or clay slurry: Mud weight is a minimum of 11 lb per gal.
Wyoming	Follow DOT regulations		

Table 6. Statistical Summary of United States Responses.

Note: All percentages based on 49 surveys unless otherwise stated. 407 surveys were sent out - 12.0% surveys were returned.

Part I - Current Policy

1. Aware of any existing guidelines or regulations pertaining to sealing geotechnical exploratory holes:

Yes	51.0 %
No	46.9 %
No response	2.0 %

2. Aware of any published guidelines for sealing geotechnical exploratory holes:

Yes	30.6 %
No	65.3 %
No response	4.1 %

3. Currently have an "in-house" policy regarding sealing of geotechnical exploratory holes:

Yes	63.3 %
No	32.7 %
No response	4.1 %

4. Constrained by current environmental protection policies or legislation in performing tasks related to transportation related geotechnical exploration activity involving sealing:

Yes	4.1 %
No	89.8 %
No response	6.1 %

5. Prevented from drilled exploratory holes due to concerns with sealing the holes to prevent potential contamination of the subsurface environment:

Yes	14.3 %
No	83.7 %
No response	4.1 %

6. Verification of hole sealing a requirement of either the current regulatory of in-house policy:

Yes	26.5 %
No	71.4 %
No response	2.0 %

Part II - Current Practice - Hole Backfilling/Sealing

7. 98.0 % Responded
2.0 % Did not respond

Sealing Material	Clay	Silt	Sand & Gravel	Rock
No Sealing	8.3 %	6.3 %	6.3 %	4.2 %
Native Soil Cuttings	43.8 %	43.8 %	43.8 %	22.9 %
Native Soil Cuttings Mixed With Bentonite	10.4 %	10.4 %	12.5 %	4.2 %
Native Soil Cuttings Mixed With Cement	0 %	0 %	0 %	2.1 %
Native Soil Cuttings Mixed With Cement & Bentonite	0 %	0 %	4.2 %	0 %
Bentonite Only	39.6 %	35.4 %	41.7 %	31.3 %
Cement Only	18.8 %	18.8 %	16.7 %	27.1 %
Bentonite/Cement Only	58.3 %	54.2 %	52.1 %	66.7 %
Chemical Grouts (Surseal, Volclay, Holeplug)	8.3 %	8.3 %	8.3 %	8.3 %
Other Seals (Sand/Cement)	0 %	2.1 %	2.1 %	2.1 %

Note: Based on surveys that responded (48).

13. 42.9 % Responded
57.1 % Did not respond

Sealing Material	Clay	Silt	Sand & Gravel	Rock
No Sealing	4.8 %	4.8 %	4.8 %	4.8 %
Native Soil Cuttings	14.3 %	14.3 %	14.3 %	9.5 %
Native Soil Cuttings Mixed With Bentonite	4.8 %	4.8 %	4.8 %	4.8 %
Native Soil Cuttings Mixed With Cement	0 %	0 %	0 %	0 %
Native Soil Cuttings Mixed With Cement & Bentonite	0 %	0 %	0 %	0 %
Bentonite Only	47.6 %	57.1 %	57.1 %	57.1 %
Cement Only	23.8 %	23.8 %	23.8 %	28.6 %
Bentonite/Cement Only	57.1 %	57.1 %	57.1 %	61.9 %
Chemical Grouts (Surseal, Volclay, Holeplug)	9.5 %	9.5 %	9.5 %	9.5 %
Other Seals (Sand/Cement)	0 %	0 %	0 %	0 %

Note: Based on surveys that responded (21).

8. Seal tamped or otherwise packed in the hole:

Yes	38.8 %
No	49.0 %
No response	12.2 %

9. Portion of the hole sealed:

Entire	74.0 %
Lower Half	6.0 %
Upper Quarter	2.0 %
Whatever Length the Cuttings will Fill	2.0 %
85 % of the Hole	2.0 %
None	2.0 %
To within 1 or 2 ft of the surface	2.0 %
No Response	10.0 %

10. Hole sealing practice depend on whether or not the hole has penetrated the groundwater table:

Yes	36.7 %
No	63.3 %

11. Method of drilling/sampling/in situ testing influence the use and selection of sealing materials and methods of placement:

Yes	28.6 %
No	71.4 %

12. Special backfill/sealing practices used to specifically protect the subsurface environment when installing instrumentation in holes:

Yes	32.7 %
No	59.2 %
No Response	8.2 %

14. Attempt made to seal holes after performing "displacement" type in situ tests:

Yes	20.4 %
No	69.4 %
No response	10.2 %

15. The effectiveness of the seal monitored:

Yes	10.2 %
No	87.8 %
No response	2.0 %

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Selected grouts and a tracer were evaluated for the potential to contaminate groundwater at hazardous and toxic waste sites. The grouts and tracer were proposed for use with the SCAPS penetrometer. Using a risk assessment approach, it was concluded from the effects phase that contamination was unlikely. Hence, the exposure phase was not necessary.

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